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PHYCOLOGICAL CONTRIBUTIONS
II TO VI

BY

WILLIAM ALBERT SETCHELL
AND
NATHANIEL LYON GARDNER

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Index in press.

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CONTENTS

PAGES

II.* New Species of Myrionema 334
III. New Species of Compsonema 353
IV. New Species of Hecatonema 377
V. New Species of Pylaiella and Streblonema 385
VI. New Species of Ectocarpus 403

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II. NEW SPECIES OF MYRIONEMA

Introduction

Critical study of an extensive series of material of small filamentous species of Melanophyceae, mostly epiphytic upon larger Melanophyceae, but in part epiphytic upon other algae and upon eel-grass, has brought to light a rather surprisingly large number of little known or wholly new species and forms on the Pacific coast of North America. Among these is a series of similar organisms which we have grouped together under the genus *Myrionema*, an account of which is presented in this paper.

We are recognizing as the principal characters of this genus: (1) a monostromatic basal disk, composed of closely crowded, short celled filaments radiating from a common center, starting from a single cell, each filament having terminal growth, and branching by radial bifurcation of the terminal cell; (2) springing outward from practically all of the cells of the basal disk, except at the margin, are erect filaments all of which may be fertile, bearing either zoosporangia or gametangia, or a part of which may remain sterile; (3) the loculi of the gametangia are uniseriate.

Myrionema primarium sp. nov.

Plate 34, figure 12

Frondibus pulvinulos orbiculares, 0.5–1.25 mm. diam., formantibus; parte prostrata filamentis regulariter radiantibus arcte compactis, formante; filamentis erectis eramosis, dense stipatis, e cellula quaque filamentorum repentium oriendis; pilis veris numerosis, per medium frondis promisque sparsis; cellulis filamentorum erectorum 4–4.5μ diam., inferne quadratis, cellula apicali juvena 2–3-plo longioribus; cellulis pilorum verorum 4–5μ diam., 4–6-plo longioribus; zoosporangiis ignotis; gametangiis in filamentis repentibus sessilibus per transformatione filamenti toti quisque erecti oriendis, maxime stipatis, in medio frondibus longitudine equalibus, prope margines brevioribus, cylindricis, 55–56μ longis, 5–6μ latis, obtusis aut apice leviter attenuatis, cellula apicali acute conica.

Growing on the outer end of the young blade of *Costaria costata* in the lower littoral and the upper sublittoral belts. Oregon (Coos Bay) to central California. Type, Gardner, no. 2764 (Herb. Univ. Calif., no. 207012), mouth of Coos Bay, May.

We are considering *Myrionema primarium* to be a typical representative of a group whose members are the most primitive of the genus as considered from the standpoint of differentiation. The prostrate basal layer is composed of long, regularly radiating filaments with apical growth. Radial divisions of apical cells occur just often enough to completely occupy all of the space between each other as the plant continues to increase in diameter and in circumference. The branching is always dichotomous, and is accompanied by widening of the apical cell, and the establishment of two growing regions on opposite corners, which are subsequently separated from the remainder of the cell by a wall, thus establishing two equal branches. Beginning in the center, each cell successively toward the periphery gives rise by horizontal divisions to erect filaments of nearly equal length, the only exception or modification being that some cells give rise to long filaments, the so-called true hairs, with the meristem at the base, and the outer cells long and colorless. All other erect filaments are transformed into gametangia. Only the cells of the basal filaments remain sterile, or probably a few short erect filaments at the periphery of the frond may never come to maturity. Thus starting with a single cell, the maximum of reproductive cells arises in this group. Starting with such forms the course of evolution seems to have been in the direction of the sterilization of tissue.

Myrionema primarium f. **acuminatum** forma nov.

Plate 32, figure 9

Frondibus microscopicis, inter algas parvas alteras crescentibus; filamentis erectis pro parte sterilibus. 80–100μ longis, cellulis leviter doliiformibus; gametangiis 4–5μ diam., acuminatis, pro parte brevipedicellatis.

Growing on *Macrocystis pyrifera*. Carmel Bay, Monterey County, California. Type, Gardner, no. 3110*b* (Herb. Univ. Calif., no. 207014), December.

There is but a slight difference between *M. primarium* and forma *acuminatum*. It is worthy of note that many gametangia in the center of the thallus are short pedicellate (plate 32, fig. 9), and that a few, about one in twenty-five, of the erect filaments continue to grow, attaining a length of two to three times as long as the gametangia.

Myrionema minutissimum sp. nov.

Plate 34, figures 1–3

Frondibus pulvinulos inconspicuos, 0.75–1.5 mm. diam., formantibus; parte prostrata filamentis dense compactis, regulariter radiantibus composita; filamentis erectis dense stipatis, cylindricis, omnibus fructiferis; pilis veris ignotis; cellulis filamentorum repentium 4μ diam., in centro frondis, quadratis, ad margines leviter longioribus quam latis; cellulis filamentorum erectorum similibus iis repentium; zoosporangiis et "ascocystis" ignotis; gametangiis pedicellis 4–8-cellulis compositis suffultis, cylindricis, dense stipatis, 34–40μ longis, 4–4.5μ latis.

Growing on the cysts of *Egregia Menziesii*. Cast ashore near the "Cliff House," San Francisco, California. Type, Gardner, no. 4123*b* (Herb. Univ. Calif., no. 207020), November.

Myrionema minutissimum may be distinguished by the absence of sterile erect filaments and hairs, and by the small sized, very densely crowded pedicellate gametangia. Thus far no "ascocysts" nor zoosporangia have been observed. In its phylogenetic relationship it would seem to stand equally close to *M. corunnae* and *M. foecundum*, differing from each, however, in details of measurements. The erect filaments are of the same diameter at their bases as the length of the cells in the creeping filaments. Since the lower part of each remains sterile, it gives the mass of cells the appearance of being parenchymatous.

Myrionema foecundum f. **simplicissimum** forma nov.

Plate 33, figures 9, 10

Frondibus pulvinulos orbiculares, 0.5–1.5 mm. diam. formantibus; parte prostrata filamentis regulariter radiantibus et arcte adhaerantibus augmentatione ramificationeque apicali composita; filamentis erectis omnibus fructiferis; pilis veris ignotis; cellulis filamentorum repentium 3–4.5μ diam., medio quadratis, prope marginem 2-plo longioribus; zoosporangiis ignotis; "ascocystis" raris usque ad numerosis, clavatis 28–34μ altis; gametangiis transformatione filamenti omnis quisque erectiis marginis frondis exceptis oriendis, 30–40μ altis, 7–9μ latis.

Growing on the sporophylls of *Nereocystis Luetkeana*. Puget Sound, Washington, to central California. Type, Gardner, no. 4316 (Herb. Univ. Calif., no. 207022), Moss Beach, San Mateo County, California, July.

We have not seen either the type or any other authentic material of *Phycocelis foecunda* Stroemfelt. Neither have we any authentic

measurements of the original. De-Toni (1895, p. 582) gives 35μ to 70μ as the height and 7μ to 12μ as the width of the gametangia. In height of gametangia our form approximates to forma *seriata* Reinke (1889, p. 46), but has no true hairs so far as we have ever been able to observe from the examination of many specimens from different localities.

At times the individuals are very numerous on the host, so much so as to interfere with each other's growth. In one collection (Gardner, no. 4651) they are completely confluent over several square inches, and the outline of the individuals can be detected only by staining and by microscopic examination.

Myrionema foecundum f. **subulatum** forma nov.

Plate 33, figures 1–3

Filamentis basalibus per ramulos numerosos, subulatos, 2–4 cellulis compositos, inter cellulas hospitis penetrantes annectis; zoosporangiis, "ascocystis" et pilis veris ignotis.

Growing on the sporophylls of *Nereocystis Luetkeana*. Near the "Cliff House," San Francisco, California. Type, Gardner, no. 4651 (Herb. Univ. Calif., no. 207028), November.

Forma *subulatum* is very similar to forma *simplicissimum*. The gametangia average slightly larger, and are usually more blunt. There are no so-called "ascocysts" present. The chief distinction is the presence in this form of numerous awl-shaped rhizoids, found in no other form of the species, so far as we have been able to ascertain.

Myrionema foecundum f. **ramulosum** forma nov.

Plate 33, figure 8

Frondibus pulvinulos parvos, orbiculares, 1–3 mm. diam. formantibus; filamentis erectis superne sparse ramosis, 55–65μ longis; cellulis filamentorum erectorum 5.5–6.5μ diam. quadratis, cellulis terminalibus frequenter 2–3-plo longioribus quam latis; zoosporangiis, "ascocystiis," et pilis veris ignotis; filamentis erectis omnibus in gametangia transformatis.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Friday Harbor, San Juan Island, Washington. Type, Gardner, no. 4065 (Herb. Univ. Calif., no. 207018), August.

This form of *M. foecundum* differs from the other forms of the species in having secund "proliferations" near to the outer ends of many of the gametangia.

Myrionema foecundum f. **divergens** forma nov.

Plate 34, figures 8, 9

Frondibus pulvinulos orbiculares, 1.5–3.5 mm. diam. formantibus; parte basali filamentis dense compactis, conjunctim et ad superficiem hospitis arcte adhaerente; filamentis sterilibus erectis exigiis, eramosis, obtusis, promisque inter gametangiis sparsis, 300–400μ longis; pilis veris deuntibus; "ascocystis" numerosis, inter, et brevioribus quam, gametangiis, sparsis, cylindricis usque ad clavatis; cellulis filamentorum repentium 5–6μ diam., 1.5–2-plo longioribus; cellulis filamentorum erectorum 8–9μ diam., 1.5–3-plo longioribus, cylindricis, non constrictis, zoosporangiis ignotis; gametangiis forma variabilibus, cylindricis, cylindro-conicis usque ad fusiformibus, 50–60μ longis, 7.5–8.5μ latis; loculis 1–2-seriatis.

Growing on the sporophylls of *Nereocystis Luetkeana*. Pacific Grove, California. Type, Gardner, no. 4511 (Herb. Univ. Calif., no. 207024), December.

This form of *M. foecundum* manifests some slight differentiations not present in any other form of the species. Scattered promiscuously over the frond are erect filaments two to three times as long as the gametangia. The "ascocysts" are abundant. Some irregularities are also shown in the creeping filaments. Typically the branching seems to take place by the splitting of the apical cell, but it seems that frequently one of the dichotomy fails to develop till later, producing the appearance of lateral branching. There is also an occasional oblique or longitudinal division of a cell of the creeping filaments perpendicular to the host.

Myrionema foecundum f. **majus** forma nov.

Plate 32, figure 7

Frondibus pulvinulos orbiculares, 1–2 mm. diam., superficie superiore convexa; parte prostrata filamentis arcte adhaerantibus, regulariter radiantibus composita; filamentis erectis dense stipatis, simplicibus, cellulis cylindricis, 5–7μ diam.; pilis veris sparsis, per frondem promiscue distributis, basim meristematicis, vaginatis, 400–500μ longis, cellulis 6μ diam. apice, 5–8-plo longioribus; "ascocystis" in filamentis prostratis sessilibus, cylindricis, apice leviter distentis, 45–55μ longis, 8–12μ latis, nunc in fronde tota sparsis nunc in gregibus isolatis; zoosporangiis ignotis; gametangiis in filamentis basalibus sessilibus, cylindricis, 60–80μ longis, 6–8μ latis, per transformationem quisque toti filamenti oriendis, dissepimentis horizontalibus aut obliquis.

Growing on *Laminaria ephemera* Setchell. Port Renfrew, Vancouver Island, Neah Bay, Puget Sound (Tacoma) and central California (Carmel Bay). Type, Gardner, no. 2910 (Herb. Univ. Calif., no. 207013), Carmel Bay, California, May.

This small epiphyte seems to be restricted in its habitat to the above named host. The only known localities in which the host has been observed are those mentioned above. The material from each locality is richly infested by this epiphyte. The host, richly infested, was distributed by Miss Josephine Tilden in her American Algae (Exsicc.), no. 609, under *Renfrewia parvula* Griggs.

It seems very closely related to *Myrionema foecundum* f. *simplicissimum*. The differences are in the larger measurements of all of the parts, the presence of numerous, larger, so-called ascocysts, occurring in groups (see plate 32, figure 7), or scattered among the gametangia, in the presence of well developed hairs, and in the more convex upper surface of the mass of erect filaments.

Myrionema corunnae f. **uniforme** forma nov.

Plate 33, figures 4, 5

Frondibus pulvinulos irregulares 0.5–1.5 mm. diam. formantibus; filamentis repentibus stratum compactum augmentatione peripherica efficientibus; pilis veris deuntibus; filamentis erectis eramosis, apice leviter attenuatis, 80–100μ (usque ad 120μ) altis; cellulis filamentorum erectorum 4.5–5.5μ diam., 1–1.5-plo longioribus; "ascocystis" sparsis, clavatis; gametangiis stratum solidum compactum, ordine palorum, centro altitudine aequalibus, ad margines gradatim diminuendis, plerumque sessilibus, nunc pedicellis 1–3 cellulis compositis suffultis, 80–100μ altis, 6–6.5μ latis; loculis uniseriatis.

Growing on the blades of *Costaria costata, Liminaria Sinclairii,* and *Alaria marginata*. Central California (Moss Beach in San Mateo County, Fort Point in San Francisco). Type, Gardner, no. 4473 (Herb. Univ. Calif., no. 207023), San Francisco, July.

Forma *uniforme* differs from the species as described and figured by Sauvageau (1897, pp. 77–82, repr., figs. 14 A–F) in having no hair filaments, in having no branched gametangia, in having "ascocysts." and in having slightly different dimensions.

There are some differences in the size of the plants we have found growing on different hosts in central California. The plants chosen as the type of the form grow on the blades of *Alaria marginata* at Fort Point, San Francisco. Very generally, this species of *Alaria* has delicate grooves obliquely radiating from the midrib to the margin. The presence of these grooves is often accentuated by the growth of this minute *Myrionema,* usually so numerous as to be confluent, so that the individuals cannot be detected except by microscopic examination.

Myrionema corunnae f. **angulatum** forma nov.

Plate 33, figures 6, 7

Frondibus pulvinulos microscopicos linea exteriore irregularibus, in hopites inter algas alteras parvas, formantibus; filamentis repentibus sub conditiones augmentationis liberae radiantibus; filamentis erectis eramosis, dense stipatis, 130–140μ longis; pilis veris deuntibus; cellulis filamentorum repentium 4–4.5μ diam., plerumque quadratis; cellulis filamentorum erectorum cylindricis, 4–4.5μ diam., 1.5–3-plo longioribus; zoosporangiis et "aseocystis" ignotis; gametangiis cylindricis, apice leviter attenuatis, in pedicellis cellulis 6–10 compositis suffultis, 35–45μ (usque ad 60μ) longis, 4–6.5μ latis, septorum multis obliquis.

Growing on the cysts of *Egregia Menziesii*. Cast ashore near the "Cliff House," San Francisco, California. Type, Gardner, no. 3471*b* (Herb. Univ. Calif., no. 207015), August.

This form is to be distinguished from the species as described by Sauvageau (1897, pp. 77–82, repr.) by the absence of hairs, the presence of sterile erect filaments, the gametangia mostly on longer pedicels and by the very small size of the loculi, often produced by perpendicular and slanting walls. In part, the gametangia seem pluriseriate, caused by the division of some of the original cells into small, angular loculi.

Myrionema corunnae f. **sterile** forma nov.

Plate 33, figures 13–15

Frondibus pulvinulos orbiculares 1.5–3 mm. diam. formantibus; filamentis erectis rectis, simplicibus, cylindricis, obtusis, 55–65μ longis; pilis veris et "aseocystiis" deuntibus; gametangiis cylindricis, obtusis, in pedicellis cellulis 3–5 compositis suffultis, raro sessilibus, 55–65μ longis, 4.5–5.5μ latis; gametangiis et filamentis erectis sterilibus e centro ad margines frondis longitudine regulariter gradatimque diminuendis.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Cast ashore, Carmel Bay, Monterey County, California. Type, Gardner, no. 4557 (Herb. Univ. Calif., no. 207027), December.

This form is to be distinguished from the species as described by Sauvageau (1897, pp. 77–82, repr.) by the presence of numerous sterile erect filaments interspersed among the gametangia, about one-fourth to one-fifth as many as the gametangia, in the absence of hairs, and in the very gradual diminution in the length of the sterile filaments and the gametangia from the center to the circumference of the fronds. The sterile erect filaments are of the same length as the gametangia.

Myrionema balticum f. **pedicellatum** forma nov.

Plate 33, figures 11, 12

Frondibus pulvinulos mieroseopicos 150–400μ (usque ad 800μ) diam., linea exteriore maxime irregulares formantibus; filamentis ereetis pro parte brevi piliferis, 140–160μ longis; pilis veris ignotis; zoosporangiis(?) anguste clavatis, in filamentis repentibus sessilibus aut in filamentis ereetis terminalibus; gametangiis in pedieellis cellulis 10–15μ compositis suffultis terminalibus aut sessilibus, usque ad 150μ longis.

Growing on the outer ends of the leaves of *Phyllospadix* sp. Point Carmel, Monterey County, California. Type, Setchell, no. 5417 (Herb. Univ. Calif., no. 207030), June.

This form differs from the speeies in the absenee of hairs, in having a few very short-piliferous, vegetative filaments, and in having the gametangia on long pedieels.

In this form, as in many others, the correet interpretation of the zoosporangia mentioned above in the diagnosis is an open question. They are filled with dense eell contents, and, although none have been observed to produee zoospores, they appear as though they might later. Whatever their nature may finally prove to be, they represent another character in which this form differs from the speeies. Reinke neither figures nor deseribes them in *Ascocyclus balticus*. They appear on the same individuals with the gametangia or on different individuals.

Myrionema balticum f. **californicum** forma nov.

Frondibus pulvinulos microseopieos, 0.5–0.75 mm. diam.; parte prostrata filamentis relative reetis, regulariter radiantibus eomposita; filamentis ereetis simplieibus, et superne et inferne leviter attenuatis, obtusis, 75–125μ longis; pilis veris 0.5–1 mm. longis; cellulis filamentorum prostratorum 6–7μ diam., 1–1.5-plo longioribus; eellulis filamentorum erectorum 7.5–10μ diam., quadratis; cellulis pilorum verorum 4–5.5μ diam., superne 6–10-plo. longioribus, basi 3–5-plo longioribus, sed eellulis paueis basim superne remotis quadratis; chromatophoris taeniatis irregulariter interruptis eompositis; zoosporangiis ignotis; gametangiis pedieellis 1–3 cellulis eompositis suffultis, aut e filamentis repentibus aut e basibus filamentorum ereetorum lateralibus oriendis, cylindrieis, 90–130μ longis, 7–9μ latis.

Growing on the outer ends of the leaves of *Phyllospadix* sp. Point Carmel, Monterey County, California. Type, Setehell, no. 5439 (Herb. Univ. Calif., no. 207031), June.

We have no authentie measurements of *Ascocyclus balticus* Reinke. He does not mention the size of the gametangia either in the Atlas

(1889, pl. 16, figs. 1–4), where he first describes and figures it, or in the Algenflora (1889*a*, p. 45) where he describes it again. Foslie (1894, p. 17, repr.) made the combination *Myrionema* (*Phycocelis*) *balticum*, but he gave no measurements for any of its parts. De-Toni (1895, p. 581) lists the plant as *Phycocelis(?) baltica* (Reinke) Foslie, but gives no additional information concerning the size of the gametangia. Kylin (1907, p. 35) lists a plant under *Myrionema balticum* (Rke.) Fosl. which he found growing on *Delesseria sanguinea* at 15 M. depth. He states that the assimilation filaments are 100–125μ long and 4–6μ broad, but gives no measurements for the gametangia.

The plant which we have diagnosed here is doubtless very closely related to Reinke's *Ascocyclus balticus*. It may be a distinct species, but we are listing it as a form of *balticus* until we can obtain more knowledge of its variation, and more authentic information concerning the type material of *balticus*. The particular distinguishing character is the very frequent occurrence of lateral gametangia arising very close to the base of the vegetative filaments.

Myrionema globosum f. **affine** forma nov.

Plate 33, figure 16

Frondibus microscopicis, 200–300μ diam., linea exteriore irregularibus, algis alteris parvis immixtis; filamentis prostratis multo distortis, libere ramosis; filamentis erectis fasciculato-ramosis, 100–140μ longis, superne attenuatis, pro parte piliferis; pilis veris 300–400μ longis; cellulis filamentorum prostratorum 4–6μ diam., forma variabilibus; cellulis filamentorum erectorum cylindricis, 4–5μ diam.; zoosporangiis ignotis; gametangiis cylindricis, 35–45μ longis, 4–4.5μ latis, in filamentis erectis sessilibus lateralibusque aut raro terminalibus; loculis uniseriatis.

Growing on the leaves of eel-grass. Sitka, Alaska, to central California (Point Carmel, Monterey County). Type, Setchell, no. 5439*a* (Herb. Univ. Calif., no. 207032), Point Carmel, June.

We have no measurements in detail for the parts of *Myrionema globosum*, this seemingly distinct species. Reinke (1889a, p. 46) states that the plants are one-half to one millimeter in diameter. Our plants seem much smaller, in general. It is difficult to make out the size on account of their being so intimately intermixed with other small algae. This is the case in both collections of plants which we have examined, one from Sitka, Alaska, and the other from Point Carmel, California. We are placing it as a form of *M. globosum* (Reinke) Foslie, awaiting knowledge of further details concerning the type.

Myrionema compsonematoides sp. nov.

Plate 34, figure 10

Frondibus pulvinulos microscopicos linea exteriore irregulares, 200–400μ diam. formantibus; parte prostrata filamentis distortis composita; filamentis erectis cylindricis, simplicibus 70–80μ altis, pilis veris ignotis; cellulis filamentorum repentium forma magnitudineque aliquantum irregularibus, 4–6μ diam.; cellulis filamentorum erectorum cylindricis, 5–7μ diam., quadratis; "ascocystis" sparses, terminalibus aut prope basim filamentorum erectorum lateralibus; gametangiis fusiformibus usque ad clavatis, sessilibus aut brevi-pedicellatis, 50–65μ longis, 7–10μ latis; loculis inferne uniseriatis, superne biseriatis.

Growing on the blade of *Laminaria complanata*. Friday Harbor, Washington. Type, Gardner, no. 4118 (Herb. Univ. Calif., no. 207019), August.

Myrionema compsonematoides seems to be a modification of *M. foecundum*. There is a slight sterilization of tissue in that a few of the erect filaments remain sterile and develop slightly beyond the gametangia, and in that a part of the gametangia are pedicellate. It seems to tend toward *Compsonema* in these respects, and in having biseriate gametangia in part.

Myrionema hecatonematoides sp. nov.

Plate 34, figure 11

Frondibus pulvinulos tenues dilute fuscos, linea exteriore irregulares, usque ad 6 mm. diam. formantibus; parte prostrata filamentis distortis, irregulariter radiantibus composita, plerumque monostromatica, pro parte distromatica, inferne ramulos radiciformes penetrantes, paxilliformes, paucos emittente; filamentis erectis simplicibus, cylindricis, 240–260μ longis; pilis veris deuntibus; cellulis filamentorum erectorum 6.5–7.5μ diam., 2–3-plo longioribus; zoosporangiis ignotis; gametangiis sessilibus aut in pedicellis 1–2-cellulis compositis e filamentis repentibus oriundis suffultis, cylindricis usque ad fusiformibus, 45–55μ longis, 7–8.5μ latis; loculis plerumque uniseriatis, in parte latiore gametangiorum biseriatis.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Pacific Grove, California. Type, Gardner, no. 4533 (Herb. Univ. Calif., no. 207025), December.

As indicated by the partial distromatic base, the slight tendency to biseriate loculi in the gametangia and the sterilization of a part of the erect filaments, this species of *Myrionema* seems to be differentiating in the direction of the genus *Hecatonema*. We are retaining it in the genus *Myrionema* because of a preponderance in number of uniseriate loculi and monostromatic filaments in the prostrate portion.

Myrionema attenuatum sp. nov.

Plate 34, figures 6, 7

Frondibus strata microscopica plus minusve confluentia in superficie hospitis formantibus; parte prostrata filamentis, regulariter radiantibus composita; filamentis erectis simplicibus superne basimque leviter attenuatis, 180–220μ longis, pilis veris deuntibus; cellulis filamentorum repentium 4.5–5.5μ diam., proxime quadratis; cellulis filamentorum erectorum 6–7μ diam., longitudine variabilibus; zoosporangiis ignotis; gametangiis sparsis, cylindricis usque ad leviter fusiformibus in pedicellis longioribus aut brevioribus, 30–45μ longis, 4.5–6μ latis.

Growing on the stipes of *Macrocystis pyrifera*, *Laminaria Farlowii*, and on the sterile base of *Gigartina radula* f. Carmel Bay, Monterey County, California. Type, Gardner, no. 4685*a* (Herb. Univ. Calif., no. 207029), December.

It seems that sterilization has proceeded in this species of *Myrionema* until about two-thirds of the erect filaments no longer produce gametangia, and these filaments are several times longer than the gametangia. The cells are slightly doliiform in some collections.

Myrionema attenuatum f. **doliiforme** forma nov.

Plate 34, figures 4, 5

Frondibus flocculos parvos, irregulares, inter algas alteras epiphyticas formantibus; filamentis erectis usque ad 275μ longis; cellulis filamentorum erectorum quadratis usque ad 3-plo longioribus quam latis haud dubie doliiformibus; gametangiis nunc parvis et in filamentis longis erectis terminalibus nunc ut in forma species typica.

Growing on the stipe of *Macrocystis pyrifera*. Carmel Bay, Monterey County, California. Type, Gardner, no. 4540*a* (Herb. Univ. Calif., no. 207026), December.

The chief distinction between this form and the species, *M. attenuatum*, is the decided doliiform character of the erect filaments. Small terminal gametangia appear very frequently on the long, erect filaments.

Myrionema phyllophilum sp. nov.

Plate 32, figures 1–5

Frondibus pulvinulos plus minusve orbiculares, 400–800μ diam. formantibus; parte repente filamentis rectis e centro radiantibus, dense compactis composita; filamentis erectis simplicibus, cylindricis, basim constrictis, 110–130μ longis, pro parte superne leviter attenuatis piliferisque; pilis veris inter filamenta gametangiaque promiscue

sparsis; cellulis filamentorum repentium cylindricis, 4–5μ diam., 2–4-plo longioribus; cellulis filamentorum erectorum 8–9μ diam., quadratis usque ad 2.5-plo longioribus; cellulis pilorum verorum basim quadratis, superne 5–6μ diam. et usque ad 20-plo longioribus; zoosporangiis(?) late clavatis, sessilibus aut in pedicellis longioribus aut brevibus suffultis, 50–70μ longis, 14–18μ superne latis; gametangiis cylindricis, plerumque in pedicellis 1–2-cellulis compositis suffultis in filamentis repentibus aut rariore in basi filamentorum erectorum lateralibus, obtusis, 90–130μ longis, 9–11μ latis; loculis uniseriatis.

Growing on the outer ends of the blades of eel-grass, in the lower littoral and upper sublittoral belts. Sitka, Alaska. Type, Gardner, no. 3969 (Herb. Univ. Calif., no. 207017), July.

In this species about one-third of the erect filaments remain sterile, and extend beyond the gametangia. The cells in the creeping filaments are relatively long. The filaments are closely crowded, but distinct and readily separable. All the erect filaments are abruptly narrowed at the base. On account of the long creeping cells, the erect filaments are very much less crowded than is usually the case in most *Myrionemas*. The erect filaments do not arise successively toward the margin of the nearly mature plants. Cells here and there develop an erect filament to the length of several cells before the intervening cells show signs of farther growth. The gametangia are typical of the genus, with uniseriate loculi and with mostly horizontal, cross cell-walls. The zoosporangia(?) are fairly abundant, and are either with the gametangia on the same individual or on separate individuals. We question these structures as being functional since none of them has been observed to produce zoospores. They have the appearance of being abortive organs, either zoosporangia or gametangia, more likely the latter, and are probably like the organs observed by Magnus which induced him to establish the genus *Ascocyclus*.

Myrioenma setiferum sp. nov.

Plate 32, figure 8

Frondibus flocculos aut pulvinulos parvos, densos, irregulares, 0.5–0.75 mm. diam. formantibus; parte prostrata filamentis regulariter radiantibus, dense compactis, cellulis 4–5μ diam., prope margines 1.5–3-plo longioribus composita; pilis veris ignotis; filamentis erectis numerosis, simplicibus, apice leviter attenuatis, longe-piliferis, 700–800μ longis; cellulis filamentorum erectorum cylindricis, 4–5μ diam., 2–3-plo longioribus; zoosporangiis late clavatis, 80–90μ longis, 18–24μ latis; gametangiis cylindricis, 150–200μ longis, 7–8.5μ latis, sessilibus aut in pedicellis curtis in filamentis erectis aut raro in filamentis repentibus suffultis; loculis uniseriatis.

Growing on the outer ends of the leaves of eel-grass, in company with other small algae, in the lower littoral belt. Sitka, Alaska. Type, Gardner, no. 3968c (Herb. Univ. Calif., no. 207016), July.

Myrionema setiferum is undoubtedly very closely related to *M. phyllophilum* on the one hand, and to *M. foecundum* f. *californicum* on the other. From the former, it differs in having longer and narrower erect filaments with longer cells and in having much longer and narrower gametangia which are more frequently borne laterally on the erect filaments, and often fasciculately branched from a short pedicel. From the latter, it differs in having functional zoosporangia, one of the few instances in which we have actually seen the undoubted zoospores, in having longer and setiferous erect filaments, and longer and slightly narrower gametangia.

Myrionema obscurum sp. nov.

Plate 32, figure 6

Frondibus microscopicis, supra superficiem hospitis irregulariter dispersis; filamentis repentibus multo ramosis, maxime compactis et contortis, stratum pseudo-parenchymaticum formantibus; filamentis erectis sparsis, simplicibus, 40–70μ altis; pilis veris ignotis; cellulis filamentorum repentium forma magnitudineque maxime irregularibus, 4.5–10μ diam., cellulis filamentorum erectorum cylindricis, 6.5–7.5μ diam., exacte aut fere quadratis; zoosporangiis numerisissimis, in filamentis repentibus, sessilibus, ovoideis usque ad late clavatis, 45–65μ longis, 18–30μ latis; gametangiis ignotis.

Growing on the blade of *Costaria costata*. Moss Beach, San Mateo County, California. Type, Gardner, no. 4315 (Herb. Univ. Calif., no. 207021), July.

Myrionema obscurum seems decidedly distinct from all other species of the genus. It seems to be a near relative of *M. strangulans* Grev. The basal layer is very compact, and adheres very firmly to the host, following closely the irregularities on its surface. We are unable to make out whether or not the epiphyte causes the death of the cells of the host, which seems to be quite frequent in all of the plants we have observed. The creeping filaments push among the dead cells of the host at times. The zoosporangia are numerous and all sessile.

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PLATE 32

Myrionema phyllophilum S. and G.

Fig. 1. A single creeping filament near the margin of a frond showing zoosporangia(?) and young erect filaments. × 250.

Fig. 2. The same as figure 1, but illustrating the gametangia. × 250.

Fig. 3. A fragment from the center of a mature plant showing a true hair, mature erect filaments with terminal hairs, and gametangia. × 125.

Fig. 4. The same as figure 3, but illustrating sessile zoosporangia(?). × 125.

Fig. 5. A segment of the basal portion showing the compact nature of the radiating filaments. × 125.

Myrionema obscurum S. and G.

Fig. 6. A few fragments of typical plants. × 125.

Myrionema foecundum f. *majus* S. and G.

Fig. 7. A terminal part of a creeping filament showing a group of so-called ascocysts, true hairs, and typical gametangia. × 250.

Myrionema setiferum S. and G.

Fig. 8. A fragment of a typical plant. × 125.

Myrionema primarium f. *acuminatum* S. and G.

Fig. 9. Fragments taken from different parts of a plant. × 250.

III. NEW SPECIES OF COMPSONEMA

Introduction

The genus *Compsonema* was established by Kuckuck. We have accepted the genus to include forms which, like *Myrionema,* start from a single cell that, by divisions, soon originates a series of closely crowded, radiating filaments, forming a monostromatic basal layer more or less circular in outline; and which, unlike *Myrionema,* produce on erect filaments numerous gametangia that develop pluriseriate loculi. The genus is very closely related to the genus *Myrionema* on one side and to *Hecatonema* on the other. No species of this genus have previously been reported from the Pacific Coast of North America.

Compsonema streblonematoides sp. nov.

Plate 35, figure 4

Frondibus pulvinulos tenues, orbiculares, 3–5 mm. diam. formantibus; parte prostrata filamentis irregularitates hospitis arcte adhaerantibus composita, inferne ramulos radiciformes inter cellulas hospitis usque ad 300–350μ profunditate penetrantes, superne filamenta sterilia gametangiaque emittente; filamentis erectis 140–160μ longis; cellulis filamentorum erectorum cylindricis, 8.5–10μ diam., 1.5–3-plo longioribus; zoosporangiis ignotis; gametangiis plerumque cylindricis, brevi-pedicellatis, 55–70μ longis, 11–14μ latis; loculis plerumque 2-seriatis.

Growing on the pneumatocysts of *Nereocystis Luetkeana.* Mouth of Tomales Bay, Marin County, California. Type, Gardner, no. 3442*a* (Herb. Univ. Calif., no. 207035), August.

Compsonema streblonematoides, like a *Streblonema,* has a large part of the vegetative portion of the frond within the host-plant, the penetrating filaments extending into the host two to three times as far as the length of the external vegetative filaments. The whole frond, however, is the result of the growth of a single cell and forms a compact monostromatic basal disk. In the character of the gametangia it is close to a *Myrionema,* but in a very large majority of cases the loculi are biseriate.

Compsonema intricatum sp. nov.

Plate 35, figures 1–3

Frondibus 1.5–2.5 mm. altis, plus minusve confluentibus, stratum continuum velutinum indefinite expansum formantibus; filamentis repentibus numerosis, profuse ramosis, flectuantibus; filamentis erectis numerosis, aut simplicibus aut basim ramis paucis brevibus instructis, rectis, apice leviter attenuatis, pro parte piliferis; pilis veris deuntibus; cellulis filamentorum repentium forma magnitudineque irregularibus; cellulis filamentorum erectorum cylindricis, 8–9μ diam., 1–2-plo longioribus, ad basim filamentorum leviter angustioribus; chromatophoris taeniatis; zoosporangiis ovoideis usque ad ellipsoideis, in filamentis brevibus e filamentis repentibus oriundis terminalibus, in filamentis erectis prope basim pedicellatis sessilibusve, lateralibus, 25–33μ longis, 18–22μ latis; gametangiis in filamentis erectis brevibus e filamentis repentibus orieundis terminalibus, in filamentis erectis ad basim sessilibus pedicellatisve lateralibus, aut in filamentis primariis erectis intercalaribus, 80–120μ (usque ad 175μ) longis, 10–14μ latis, iis terminalibus intercalaribusque usque ad 600μ longis; loculis plerumque 2-seriatis.

Growing on *Fucus furcatus* f. Carmel Bay, Monterey County, California. Type, Gardner, no. 2893 (Herb. Univ. Calif., no. 207033), May.

Compsonema intricatum has diverged very far from a typical *Compsonema*. The size of a single individual at maturity cannot be ascertained, since the creeping filaments, and to some extent the erect filaments, are thoroughly and inextricably intertwined, forming continuous velvety strata on the surface of the host for several inches in expanse. The gametangia have, to a considerable degree, moved to the lateral position, the majority, however, remain terminal on long pedicels from the basal filaments. The lateral position is characteristic of *Ectocarpus*. The intercalary gametangia are typical of the genus *Pylaiella*. The creeping filaments are very numerous, although they do not radiate regularly side by side, thus forming a regular circular disk typical of the genus *Myrionema*. The zoosporangia(?) are numerous and develop with the gametangia on the same individual. It is exceedingly doubtful whether or not these structures are functional. At the stage in which the material was found, they were practically all of the same size, and some of the accompanying gametangia were empty. There is no indication of the formation of zoospores. They are filled with what seems to be densely crowded, angular chromatophores. The apical end is slightly beaked, and the outer wall dissolved, except a thin inner membrane. Their position on the same plants with gametangia, the peculiar open beak, and the

fact that they all seem to be of the same age lead us to suspect that they are some sort of abnormalities, or pathological conditions of the gametangia, which will require much more investigation to interpret. We are retaining this in the genus *Compsonema* on account of the prevailing simplicity of the erect filaments and the abundance of creeping filaments, practically every cell of which gives rise to an erect filament.

Compsonema pusillum sp. nov.

Plate 37, figure 3

Frondibus pulvinulos tenues dilute fuscos, linea exteriore irregulares, 3–4 mm. diam. formantibus; parte prostrata filamentis tortuosis, ramosis, irregularitates superficies hospitis arcte adhaerante e latere infero filamenta pauca, brevia, et inter cellulas hospitis penetrantia emittente; filamentis erectis simplicibus, cylindricis, 270–300μ longis; cellulis filamentorum repentium maxime forma magnitudineque irregularibus; cellulis filamentorum erectorum cylindricis, 6–7μ diam., 3–5-

sessilibus aut in pedicellis longioribus brevioribusve, in filamentis erectis secundis, sessilibus pedicellatisve, aut rariore intercalaribus, gametangiis terminalibus 60–100μ longis, 14–18μ latis, gametangiis secundis variabilibus, parvioribus.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Moclips, Washington. Type, Gardner, no. 3812 (Herb. Univ. Calif., no. 207037), May.

Compsonema speciosum f. *piliferum* seems undoubtedly to be very closely related to *Myrionema speciosum* Börgesen [1902, pp. 421–424, which is the *Hecatonema speciosum* (Börgesen) Cotton, 1912, p. 15 (122) and the *Hecatonema diffusum* Kylin (cf. Cotton, *loc. cit.*)], at least the two sets of plants agree very closely in general habit and structure as described by Börgesen. Judging alone from the description and figures the chief differences are that our plant has short penetrating rhizoids, many terminal and no lateral hairs, and larger gametangia. We are unable to say that the plant would produce rhizoids on an uninjured host. The surface cells of the host are destroyed under the epiphyte, and it is an open question whether the penetrating rhizoids are or are not the cause of their death. Börgesen does not give the dimensions of the whole plant, but he states that the plants form short dense mats on the conceptacles of *Himanthalia lorea*, which would indicate that they were quite small. Our plants form circular cushions or mats 5–8 mm. in diameter. Typical zoosporangia were found at the base of the erect filaments. The lateral secund gametangia standing nearly perpendicular to the filaments of which the cell at the base in the filament becomes a part, is a character not found in *Compsonema gracilis* Kuckuck.

Compsonema sporangiiferum sp. nov.

Plate 36, figures 3–8

Frondibus pulvinulos orbiculares, 1–4 mm. diam. formantibus; parte prostrata filamentis compactis, irregularibus, plus minusve contortis, irregularitates superficies hospitis arcte adhaerantibus, monostromatica aut pro parte distromatica composita; filamentis erectis 300–700μ longis, simplicibus aut superne ramis paucis, brevibus, plerumque secundis, fructiferis indutis; cellulis filamentorum erectorum basim 6–8μ diam., 2–3-plo longioribus, apice 11–13μ diam., 1–1.5-plo longioribus, cellulis multis in parte superiore filamentorum 1–2-plo longitudinaliter divisis; chromatophoris taeniatis, in cellula quaque paucis; zoosporangiis numerosissimis, forma magnitudineque maxime variabilibus, anguste ellipsoideis, clavatis, usque ad late ovoideis, 40–130μ longis, 20–35μ latis, sessilibus aut pedicellis brevibus

e filamentis repentibus oriundis suffultis, aut in filamentis erectis lateralibus terminalibusve; gametangiis raris, cylindricis, in filamentis repentibus sessilibus brevi-pedicellatisve aut raro in filamentis erectis terminalibus tuberculatisque, 80–130μ longis, 11–15μ latis.

Growing on the pneumatocyst of *Nereocystis Luetkeana*. Neah Bay, Washington. Type, Gardner, no. 3859 (Herb. Univ. Calif., no. 207038), May.

The unusual condition in *Compsonema* prevails in *C. sporangiiferum*. The gametangia seem to be of rare occurrence. Examination of specimens of different sizes from different parts of the host revealed the presence of a large number of zoosporangia in all stages of development, many being empty. The gametangia are prevailingly near the base, although occasionally a complex one appears terminal on an erect filament. A very common character is the division of the cells in the upper parts of the filaments into 2–4 parts by longitudinal walls, producing a slight clavate condition in such filaments. We do not know, at present, the morphological significance of this condition. The zoosporangia and the gametangia, so far as observed, develop on distinct individuals.

Compsonema sessile sp. nov.

Plate 39, figure 6

Frondibus pulvinulos inconspicuos usque ad 1.5 mm. diam., in linea exteriore orbiculares usque ad irregulares formantibus; filamentis repentibus contortis, dense compactis, hospitem arcte adhaerantibus, ramulis radiciformibus deuntibus: filamentis erectis sparsis 20–24μ altis; pilis veris deuntibus; cellulis filamentorum repentium forma magnitudineque irregularibus, 9–12μ diam.; chromatophoris taeniatis in cellula quaque singulis; zoosporangiis ignotis; gametangiis numerosis, in filamentis repentibus sessilibus, conicis usque ad fusiformibus, 16–22μ longis, 11–14μ latis, parietibus multorum loculorum obliquis.

Growing on the lamina of *Hedophyllum sessile* near the outer end. Neah Bay, Washington. Type, Gardner, no. 3866 (Herb. Univ. Calif., no. 207039), May.

Compsonema sessile represents the extreme of the genus in the direction of simplicity. There are no hair filaments, and it is doubtful if any of the erect filaments remain sterile. At times even the cells of the basal layer seem to become a part of the gametangia, at least more than one cell in the basal layer may be at the base of a single gametangia. There would seem to be only a single modification of a *Myrionema* of the simplest type to produce this species, viz., the change in the type of gametangium from uniseriate to pluriseriate. If

we hold to the principal distinction between *Compsonema* and *Myrionema*, it will be necessary to ally this species with the former. It was found growing in company with *Streblonema aecidioides* f. *pacificum* S. and G., which gave to the host a roughened appearance, otherwise it probably would not be noticeable without microscopic examination.

Compsonema tenue sp. nov.

Plate 37, figure 6

Frondibus microscopicis, stratum plus minusve continuum in hospite inter algas parvas alteras formantibus; filamentis repentibus numerosis, ramosis, irregularitates superfices hospitis arcte adhaerantibus; filamentis erectis sparsis, simplicibus, apice basimque leviter attenuatis, 80–100μ altis; pilis veris sparsis; cellulis filamentorum repentium forma magnitudineque irregularibus; cellulis filamentorum erectorum cylindricis, non constrictis, 7–8μ diam., 1.5–2.5-plo longioribus; cellulis filamentorum piliferorum cylindricis, 5.5–6.5μ diam., inferne exacte aut fere quadratis, superne 7–10-plo longioribus; zoosporangiis(?) clavatis, 24–28μ longis, 8–10μ latis, sparsis; gametangiis fusiformibus usque ad irregulariter conicis, in filamentis repentibus sessilibus, numerosis, 22–28μ longis, 7–11μ latis; loculis plerumque 2-seriatis.

Growing on the fruiting fronds of *Cystophyllum geminatum*. Sitka, Alaska. Type, Gardner, no. 3972 (Herb. Univ. Calif., no. 207040), July.

Compsonema tenue, though scarcely typical of the genus, seems to possess affinities as closely allied to *Compsonema* as to any other genus, and hence we are placing it here for the present.

Compsonema nummuloides sp. nov.

Plate 35, figures 5, 6

Frondibus pulvinulos tenues orbiculares, 7–12 mm. diam. formantibus; parte prostrata filamentis radiantibus, multo crispatis, dense compactis, irregularitates superficies hospitis arcte adhaerantibus composita; filamentis erectis simplicibus, numerosis, 300–400μ longis, apice basimque leviter attenuatis; pilis veris deuntibus; cellulis filamentorum repentium forma magnitudineque multo irregularibus; cellulis filamentorum erectorum cylindricis, basim 6–7μ diam., 3–8-plo longioribus, in parte latissima 9–11μ diam., cellula apicali quadrata 6–7μ diam., 3–8-plo longiore; zoosporangiis ignotis; gametangiis plerumque sessilibus aut brevi-pedicellatis, nunc in filamentis erectis terminalibus, 70–90μ (usque ad 140μ) longis, 11–15μ latis; loculis plerumque 2-seriatis.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Moss Beach, San Mateo County, California. Type, Gardner, no. 4318 (Herb. Univ. Calif., no. 207041), July.

Compsonema nummuloides forms thin, light brown cushions on the pneumatocysts of the host. The whole cushion is a single plant, circular in outline and attaining a diameter of twelve or more millimeters, although the majority of the plants are much smaller. Like a typical *Myrionema* the plant starts from a single cell and by divisions forms a series of filaments radiating in all directions with apical growth and dichotomous branching, by the splitting of the apical cell, thus forming a continuous monostromatic layer of cells. Beginning in the center, practically every cell in each radiating filament of the basal layer gives rise successively to an erect filament, about two- thirds of which are fructiferous, the others remaining sterile. A very large majority of the gametangia are sessile or on short pedicels, thus occupying a zone near the creeping filaments, a *Myrionematoid* character, but the remainder of the filaments continue to grow and attain a length of 300–400μ. Some of these filaments are terminated by relatively short gametangia. This is one of several species with this general method of development which has been found growing only on the above mentioned host, differing from each other and from the type of the genus, *C. gracile* Kuckuck, in the size of the plant as a whole, in details of dimensions of their parts, in the presence or absence of zoosporangia and hairs, in the position of the gametangia, and in the relative amount of sterile filaments. It seems to form a fairly compact group but with overlappings, however, in the genera *Streblonema*, *Myrionema*, and *Hecatonema*.

Compsonema fasciculatum sp. nov.

Plate 38, figures 7–9

Frondibus floeculos mieroseopicos plus minusve confluentes formantibus; filamentis repentibus tortuosis, hospitem sine ramulis radicifornibus adhaerantibus; filamentis erectis prope basim ramosis, 90–130μ longis, basim apiceque attenuatis, non piliferis, ad dissepimenta constrictis; pilis veris deuntibus; cellulis filamentorum erectorum in parte latissima, 10–14μ diam., 1–2-plo longioribus; zoosporangiis ignotis; gametangiis forma moderate irregularibus, conicis usque ad fusiformibus, 35–45μ longis, 12–18μ latis; plerumque lateralibus, brevipedicellatis.

Growing on *Gigartina radula* f. Pacific Grove, California. Type, Gardner, no. 4503 (Herb. Univ. Calif., no. 207042), December.

This species is allied here rather than with *Ectocarpus* because of its extremely small size and its creeping, fasciculate habit.

Compsonema myrionematoides sp. nov.

Plate 36, figure 1

Frondibus pulvinulos parvos, orbiculares usque ad irregulares, 1–2.5 mm. diam. formantibus; parte prostrata arcte monostromatica, filamentis dense compactis, tortuosis, radiantibis composita; filamentis erectis simplicibus, cylindricis, 110–130μ longis; pilis veris deuntibus; cellulis filamentorum repentium forma cylindricis usque ad irregularibus; cellulis erectorum cylindricis, 7.5–8.5μ diam., 1–2-plo longioribus, terminalibis plerumque plurimo longioribus; chromatophoris leviter interrupto-taeniatis, in quaque cellula singulis; zoosporangiis(?) late clavatis sessilibus aut brevi-pedicellatis e cellulis filamentorum repentium oriundis, 35–50μ longis, 20–28μ latis; gametangiis numerosis, cylindricis usque ad fusiformibus sessilibus aut brevi-pedicellatis e cellulis filamentorum repentium orundis, 50–70μ (usque ad 100μ) longis, 9–12μ latis.

Growing on the stipe of *Nereocystis Luetkeana*. Pacific Grove, California. Type, Gardner, no. 4510 (Herb. Univ. Calif., no. 207043), December.

There is but little choice as to the generic position of this small alga. It forms small brown tufts or cushions of loose filaments. Very frequently the gametangia are wider in the middle than at the ends and have decidedly biseriate loculi. Because of the more or less loose tufted character of the erect filaments and the partially biseriate gametangia we are placing it with the genus *Compsonema*.

Compsonema secundum sp. nov.

Plate 37, figures 1, 2

Frondibus parvissinus, plerumque plus minusve confluentibus; parte prostrata monostromatica, filamentis crispatissimis, ramosis composita; cellulis filamentorum repentium forma irregularibus, 7–8μ diam., longitudine variabilibus; filamentis erectis usque ad 1.25 mm. altis, simplicibus aut raro ramulis paucis brevibus fructiferis instructis; cellulis filamentorum erectorum cylindricis, basim 5.5–6.5μ diam., 4.5–6-plo. longioribus, in parte latissima 9.5–10.5μ diam., cellulis terminalibus usque ad 9-plo longioribus quam latis; chromatophoris taeniatis; zoosporangiis late clavatis, 60–90μ longis, 22–28μ latis, sessilibus aut brevi-pedicellatis e cellulis filamentorum repentium oriundis; gametangiis maxime variabilibus, raro pedicellis brevibus e filamentis repentibus oriundis suffultis, interdum per transformatione partis superioris filamenti erecti longi extensis, nunc simplicibus, nunc prolificationes numerosas laterales, breves plerumque secundas, raro oppositas producentibus, usque ad 400μ longis, 11–15μ latis, obtusis, clavatis.

Growing on the pneumatocyst of *Nereocystis Luetkeana*. West coast of Washington (Moclips) to central California (Carmel Bay). Type, Gardner, no. 4547 (Herb. Univ. Calif., no. 207044), Carmel Bay, California, December.

Like *Compsonema ramulosum*, *C. secundum* has gametangia occupying a variety of positions and assuming a diversity of forms. The form of gamentangium which marks the species is the long terminal form which develops numerous, short, blunt-conical, seriate, secund, sessile gametangia, thus forming a complex composed of these gametangia and the metamorphosed cells in the upper part of the filament. The end of the filament becomes reflexed, at times almost scorpioid. The specimen from Moclips, Washington, was taken in May and the gametangia were practically all empty. The other parts of the plants manifested signs of old age conditions. They seem to belong to this species, but the filaments have a considerably greater diameter. Typical zoosporangia with well formed zoospores have been observed in this collection.

Compsonema ramulosum sp. nov.

Plate 39, figures 1–5

Frondibus pulvinulus orbiculares, 5–7 mm. diam. formantibus: parte prostrata monostromatica, filamentis plus minusve contortis et irregulariter ramosis, radiantibus composita: filamentis erectis pro parte piliferis simplicibus aut ramos breves plerumque fructiferos, secundos et interdum pilos ferentibus, basim leviter attenuatis; cellulis filamentorum repentium 6–7μ diam., quadratis aut leviter longioribus quam latis: cellulis filamentorum erectorum basim 6–7.5μ diam., superne leviter latioribus, 1–3.5-plo longioribus; cellulis ramorum pilorumque 4–6μ diam.; chromatophoris taeniatis, plus minusve interruptis angularibusque; zoosporangiis(?) late clavatis, terminalibus pedicellis longioribus bervioribusve suffultis aut prope apices filamentorum erectorum lateralibus, secundis aut verticillatis; gametangiis forma, magnitudine et positione maxime variabilibus, in filamentis repentibus sessilibus pedicellatisve, in filamentis erectis lateralibus, aut in filamentis primariis aut in ramulis lateralibus brevibus intercalaribus terminalibusve, clavatis, cylindricis, usque ad cylindrico-conicis, usque ad 140μ longis, 16μ latis; loculis plerumque 2-seriatis.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Carmel Bay, Monterey County, California. Type, Gardner, no. 4549 (Herb. Univ. Calif., no. 207045), December.

There exists in this species extreme variation in the form, size, and position of the gametangia. Some are sessile on the creeping filaments, though they are more frequently to be found on the pedicels up to

fifteen cells long. At times sessile forms are to be found on the erect filaments about two-thirds of the way up to the apex, but more generally they are terminal on small lateral ramuli on the erect filaments arising from the middle to near the apices. Rarely there are small lateral forms on the ramuli. Finally, they may rarely be terminal or intercalary and seriate on the erect filaments although the erect filaments are usually piliferous. The terminal forms on pedicels, and particularly on the main erect filaments, are often quite blunt, even clavate. Others on the prostrate filaments are narrow and sharply attenuated, at times terminated by a sterile pointed filament, in effect intercalary. Many of the gametangia, terminal on the ramuli, are composed of a single series of loculi. Most of the others are two or more seriate. The hair filaments do not seem to be abundant. They arise laterally on the main filaments, usually above the center. The meristem in these hairs is at the base which is surrounded by a sheath similar to that described by Sauvageau (1897, p. 47) for *Myrionema*. The ramuli are decidedly curved upwards.

The species is similar to *Myrionema speciosum* from the Faeröes, described by Börgesen (1902, p. 421). Our plant is more slender in all of its parts, has much longer gametangia, and possesses, in addition to the sessile, secund gametangia figured by Börgesen, occasional intercalary ones and many terminal ones on the numerous clustered ramuli. These ramuli are in turn, occasionally branched, usually arise in groups, sometimes whorled, two or three arising from the same cell, in other instances they are secund.

The species often grows in association with other members of the Myrionemataceae and the Ectocarpaceae. As a rule, the main erect filaments do not enter into the formation of gametangia, but give rise either to sessile gametangia or to the ramuli. No zoospores have been observed in the so-called zoosporangia. We suspect that these may represent pathological conditions.

Compsonema serpens sp. nov.

Plate 39, figure 7

Frondibus stratum plus minusve expansum in superficie hospitis formantibus; parte repente filamentis multo contortis, irregulariter ramosis composita; filamentis erectis simplicibus aut raro superne ramis paucis subulatis indutis, inferne leviter attenuatis, superne gradatim attenuatis, non piliferis, 375–425μ longis; pilis veris deuntibus; cellulis filamentorum repentium cylindricis ad dissepimenta usque ad irregularibus, 10–13μ diam., 0.5–3-plo pongioribus; cellulis

filamentorum erectorum cylindricis non constrictis, basi 5.5–8.5μ diam., in parte latiore, 10–17μ diam., 1.25–2.5-plo longioribus; chromatophoris taeniatis, in cellulis juvenis dense aggregatis, in cellulis senioribus numerosissimis et segregatis; zoosporangiis ignotis; gametangiis cylindrico-conicis, in pedicellis longioribus brevioribusve e filamentis repentibus oriundis terminalibus, raro in filamentis longis erectis terminalibus, 60–130μ longis, 18–28μ latis.

Growing on the sterile base of *Gigartina radula* f., in company with several other small algae. Cypress Point, Monterey County, California. Type, Gardner, no. 4684 (Herb. Univ. Calif., no. 207046), December.

This diminutive member of the Melanophyceae is on the border line between *Compsonema* and *Ectocarpus*. Our comprehension of these two genera, so far as the vegetative portion is concerned, is that a typical *Compsonema*, starting from a single cell, develops an extensive, creeping, attaching mass of filaments, radiating in all directions from the origin, which later produces very numerous erect filaments, some of which may remain sterile and others become fructiferous; and that a typical *Ectocarpus*, starting likewise from a single cell, develops a rather insignificant series of attaching filaments, more or less rhizoidal in nature, and a relatively extensive system of erect filaments finally producing the fruit. Starting with this conception concerning the two genera, we are assuming that differentiation has proceeded from *Compsonema* in the direction of the reduction of the creeping portion, to a more extensive development of the erect portion, finally resulting in an *Ectocarpus*.

The species under consideration has a relatively extensive system of creeping filaments but very much less so than that of a typical *Compsonema*. The creeping filaments do not form a solid disk, but those from different plants are so intertwined that it is impossible to determine the limits of a distinct individual. In this character it resembles an *Ectocarpus*. The gametangia are like those of a typical *Ectocarpus*, but since they are mostly short pedicellate and spring directly from the creeping filaments, as is the case in a typical *Compsonema*, and because of the relatively extensive system of creeping filaments, we have placed it in the latter genus.

Compsonema coniferum sp. nov.

Plate 38, figure 3

Frondibus microscopicis, plus minusve confluentibus, stratum velutinum in superficie hospitis algis alteris minutis immixtis formantibus; parte prostrata filamentis profuse ramosis, multo contortis composita; filamentis erectis numerosis, simplicibus, apice basimque leviter attenuatis, non piliferis, 150–200μ altis; pilis veris deuntibus; cellulis filamentorum repentium forma magnitudineque irregularibus, 6–7.5μ latis, 9–12μ longis; cellulis filamentorum erectorum cylindricis usque ad leviter doliiformibus in parte latiore, 8–10μ diam., 1–1.5-plo longioribus; chromatophoris taeniatis; zoosporangiis ignotis; gametangiis sessilibus aut in pedicellis brevibus e filamentis repentibus oriundis, angusta conicis, 46–65μ longis, 15–18μ latis.

Growing on the sterile base of *Gigartina radula* f. Cypress Point, Monterey County, California. Type, Gardner, no. 4684*a* (Herb. Univ. Calif., no. 207047), December.

Compsonema coniferum seems to be a very close relative of *C. fasciculatum*, found growing on the same host. The fronds are more extensive, unbranched, and have larger gametangia. We consider this species of *Compsonema* a very near approach to an *Ectocarpus* of extremely small size. We are inclined toward the genus *Compsonema* as a more appropriate genus for this species than *Ectocarpus* on account of its extensive creeping habit and prolific production from the creeping filaments of nearly sessile gametangia and many sterile erect filaments. It is to be found quite commonly associated on the same host with several other species of Myrionemataceae.

Compsonema dubium sp. nov.

Plate 38, figure 6

Frondibus diminutivibus, flocculos parvos inter algas microscopicas alteras in hospite formantibus; parte prostrata filamentis multo contortis, ramosis, repentibus composita; filamentis erectis simplicibus, totaliter prope exacte cylindricis, 275–350μ longis, non piliferis; pilis veris deuntibus; cellulis filamentorum repentium forma magnitudineque maxime variabilibus; cellulis filamentorum erectorum cylindricis, medio 7–9μ diam., superne inferneque minoribus, 2–3-plo longioribus; zoosporangiis(?) ellipsoideis, terminalibus, brevi-pedicellatis 16–22μ longis, 12–15μ latis; gametangiis cylindricis usque ad leviter fusiformibus, in pedicellis longioribus brevioribusve filamentis repentibus oriundis, terminalibus, raro in filamentis longis erectis terminalibus, 50–75μ longis, 8–11μ latis; loculis plerumque 2-seriatis.

Growing on the sterile base of *Gigartina radula* f. Cypress Point, Monterey County, California. Type, Gardner, no. 4684*d* (Herb. Univ. Calif., no. 207048), December.

Compsonema dubium, like *C. coniferum* and *C. serpens,* has close affinities with small members of the genus *Ectocarpus.* Its relatively long and narrow gametangia distinguish it from the two species here mentioned, with which it is frequently associated.

Compsonema secundum f. **terminale** f. nov.

Plate 37, figures 4, 5

Frondibus stratum indefinite expansum, velutinum, per filamenta maxime distorta, ramosa, repentia, per ramulos radiciformes, numerosis, penetrantes, e superficie infera oriendes affixum formantibus; filamentis erectis 700–800μ (usque ad 1 mm.) longis, simplicibus aut ramulos paucos, breves, secundos, fructiferos producentibus, rectis, basim leviter attenuatis, superne cylindricis; cellulis filamentorum repentium et ramulorum radiciformium irregularibus, magnitudine variabilibus; cellulis filamentorum erectorum cylindricis, ad dissepimenta non constrictis a 6–8μ diam., basi 2–3.5-plo, superne 0.5–2-plo, longioribus; chromatophoris irregulariter taeniatis, in cellula quaque paucis; zoosporangiis(?) late clavatis, e filamentis repentibus oriundis, 50–60μ longis, 18–22μ latis, sessilibus, brevi-pedicellatisve, aut terminalibus seriatisque, proliferationibus lateralibus secundisque indutis; gametangiis e filamentis repentibus oriundis, sessilibus aut longe-pedicellatis, 90–110μ longis, 15–18μ latis, proxime cylindricis aut in filamentis erectis terminalibus, clavatis, frequenter prolongationibus tubereulatis, secundis et magnitudine variabilibus.

Growing on the pneumatocysts of *Nereocystis Luetkeana.* Central California (San Francisco and Pacific Grove). Type, Gardner, no. 4690 (Herb. Univ. Calif., no. 207049), Pacific Grove, December.

This form of *Compsonema* is to be distinguished by the great predominance of relatively short terminal gametangia, and many relatively large, lateral, secund, sessile gametangia which are curved upwards. There are a few sessile or short pedicellate examples at the base and a few lateral forms on short ramuli. Specimens taken in December had the larger number of gametangia empty.

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PLATE 35

Compsonema intricatum S. and G.

Fig. 1. A diagrammatic illustration of a part of a plant.

Fig. 2. A part of a plant showing a variety of forms of gametangia, lateral and pedicellate or sessile, terminal, and intercalary; also numerous zoosporangia(?) on the same plant and also, in some cases, on the same filament. × 125.

Fig. 3. A small part of a plant showing the acute erect filaments, and pedicellate gametangia and zoosporangia. × 225.

Compsonema streblonematoides S. and G.

Fig. 4. A part of a section through a plant and its underlying host, showing a basal filament on the surface and rhizoidal filaments penetrating into the host, and erect filaments and gametangia above. × 250.

Compsonema nummuloides S. and G.

Fig. 5. A segment of the sterile creeping filaments showing the method of branching. × 125.

Fig. 6. Eight fragments of plants showing the various shapes and positions of the gametangia and the character of the erect filaments. × 125

IV. NEW SPECIES OF HECATONEMA

Introduction

The genus *Hecatonema* was established by Sauvageau (1897, p. 249). We have in the Herbarium of the University of California numerous collections of small epiphytic plants found upon *Nereocystis Luetkeana* in various localities on the Pacific Coast, which we have placed in the genus *Hecatonema*. This genus, as we interpret it, is quite similar to *Compsonema* and to *Myrionema*, but differs from each in having a distromatic base. Of the two, it seems more nearly akin to *Compsonema* than to *Myrionema* in that it develops gametangia with pluriseriate loculi instead of uniseriate, as is the case in *Myrionema*.

There have been no species of this genus reported previously on the Pacific Coast of North America. This study is but a preliminary one and it is hoped that it may stimulate further investigation of this genus as well as of the other closely related genera.

Hecatonema variabile sp. nov.

Plate 41, figures 1–12

Frondibus pulvinulos orbiculares, 4–7 mm. diam. formantibus; parte prostrata filamentis radiantibus subapicaliter ramosis, per ramulos radiciformes numeros, breves, 1–3-cellulates adhaerantibus composita; filamentis erectis non dense stipatis, non e centro ad peripheriam seriater evolvatis, simplicibus, 400–500μ longis; pilis veris ignotis; cellulis filamentorum repentium forma irregularibus, 7–9μ diam., margine 1–3-plo longioribus; cellulis filamentorum erectorum basim 4.5–5μ diam., 2–5-plo longioribus, apice 8–10μ diam., 1–3-plo longioribus; zoosporangiis(?) late clavatis in filamentis prostratis sessilibus brevi-pedicellatisve raro in filamentis erectis terminalibus lateralibusve, 50–65μ longis, 20–24μ latis; gamentangiis cylindricis, apice leviter attenuatis, in filamentis sessilibus brevi-pedicellatisve, raro in filamentis erectis terminalibus, 70–120μ longis, 9–12μ latis; loculi 1–2-seriatis.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Carmel Bay, Monterey County, California. Type, Gardner, no. 3109 (Herb. Univ. Calif., no. 207050), December.

From the standpoint of the structure of the gametangia, the type of this species of *Hecatonema* could scarcely be separated from a

Myrionema such as *M. phyllophylum* S. and G. They, in part, possess uniseriate loculi, but have many perpendicular and slanting walls, making a partial biseriate condition. The basal layer, particularly in the center of the thallus, is distinctly distromatic, developing numerous peg-like rhizoids, which serve to anchor it more firmly to the host, and, for the most part at least, the branching of the filaments is subterminal, whereas that of a true *Myrionema* is terminal and brought about by the splitting of the apical cell.

The size of the plants as a whole varies considerably. The material of the type varies in this respect from 4 mm. to 7 mm. in diameter. In some collections of specimens which we have included under the species, the specimens are as small as 2 mm. in diameter, in others they are up to 10 mm. in diameter. The length of the erect filaments varies from 150μ to 500μ. Mature gametangia vary from 55μ to 120μ long. The relative number of gametangia terminal on the erect filaments, as well as their size and complexity, is exceedingly variable in different collections. Two or three cells only may metamorphose in some filaments, in others eight or ten. Occasionally small lateral outgrowths from these metamorphosed cells may occur. The number of erect filaments in proportion to the number of gametangia is a character which seems to be very unstable. In some collections they exceed the number of gametangia almost two to one, in others they do not occur more than in proportion of one to five. They are very irregular in origin along the radiating creeping filaments. Some near the margin of the frond may be nearing maturity before others near the frond have started (pl. 41, fig. 5).

Hecatonema clavatum sp. nov.

Plate 40, figures 1–4

Frondibus pulvinulos orbiculares, 2–3 mm. diam., margine lato filamentis erectis destituta formantibus; parte prostrata per ramulos radiciformes numerosos, breves, subulatosque adhaerente, et filamentis regulariter radiantibus, dense compactis composita; filamentis erectis plerumque clavatis simplicibus, 190–210μ longis; cellulis filamentorum repentium 5–6μ diam., 1.5–2-plo longioribus; cellulis filamentorum erectorum inferne cylindricis, 5.5–6.5μ diam., 2–2.5-plo longioribus, superne ad discepimenta leviter constrictis, 8–11μ diam., 1.5-plo longioribus; zoosporangiis(?) in filamentis repentibus, sessilibus subsessilibusve, clavatis, 60–80μ longis, 10–14μ latis; gametangiis cylindricis usque ad leviter fusiformibus, in filamentis repentibus sessilibus brevi-pedicellatisve, 55–85μ (usque ad 110μ) longis, 8–12μ latis; loculis plerumque 2-seriatis.

Growing on the pneumatocysts of *Nereocystis Luetkeana*. Mouth of Tomales Bay, Marin County, California. Type, Gardner, no. 3456 (Herb. Univ. Calif., no. 207051), May.

The structures designated zoosporangia(?) in the above diagnosis of this species were found interspersed among the gametangia. No indication of the formation of zoospores has been observed, which leads to the suspicion that they may be abortive gametangia. The terminal cells of the erect filaments are often longer than the cells below it, and in these filaments in which the cells are divided lengthwise, producing the clavate condition, the terminal cell degenerates in a similar manner as do the hairs in other species. The longitudinal division of cells in the upper parts of the filaments is undoubtedly connected with the formation of the short, lateral, often secund, gametangia characteristic of nearly related species in *Hecatonema* and in *Compsonema*, for in a few instances such gametangia were observed in old specimens in which the gametes had, to a large degree, escaped from the characteristic gametangia.

Hecatonema Lawsonii sp. nov.

Plate 40, figures 5–7

Frondibus pulvinulos microscopicos, 250–500μ diam., linea exteriore irregulares formantibus; parte prostrata filamentis maxime contortis, profuse ramosis, subterminaliter furcatis composita; filamentis erectis stratum compactum valliforme filamenta pilifera numerosa sparsa includens formantibus, 0.75–1.5 mm. longis; cellulis filamentorum repentium radianter tangentialiterque divisis, in centro thalli pseudoparenchyma formantibus, forma irregularibus, 4–5μ diam.; cellulis filamentorum piliferorum basi quadratis et vaginatis, superne usque ad 25-plo longioribus quam latis; zoosporangiis ignotis; gametangiis cylindricis usque ad leviter fusiformibus, 25–30μ longis, 5–6.5μ latis; loculis multis per parieties longitudinales et obliquos formatis.

Growing on the sporophylls of *Nereocystis Luetkeana*. Uyak Bay, Alaska. Type, Setchell and Lawson, no. 5131 (Herb. Univ. Calif., no. 99357), August.

Myrionema vulgare Collins, Holden and Setchell, Phyc. Bor.-Amer. (Exsicc.), no. 924 (non Thuret). *Myrionema strangulans* Setchell and Gardner, Alg. N. W. Amer., 1903, p. 249 (non Grev.).

This plant superficially resembles very closely *Myrionema foecundum* f. *simplicissimum* S. and G. Microscopic examination, however, reveals several important differences. The creeping filaments are unique. The branches are very numerous, come off at wide angles and seem, for the most part at least, to be subterminal, or if the terminal

cell splits, one of the dichotomy very frequently fails to develop till much later. Many of the cells in the center, and even toward the periphery, divide radially and perpendicular to the surface of the host, forming a pseudoparenchymatous layer. Thus this species, strictly speaking, cannot be said to be distromatic, since the distromatic condition of a frond is really brought about by *radial* divisions of the cells of filaments, but parallel to the surface of the host. The character of the gametangia and of the creeping filaments will not permit of its being placed with *Myrionema vulgare* Thuret as further described and figured by Sauvageau (1897, p. 186, *et seq.*). On account of the radial divisions of the creeping filaments and the prevailing biseriate condition of most of the gametangia, we are placing this species with the genus *Hecatonema* and dedicating it to Professor A. A. Lawson, one of the collectors.

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PLATE 40

Hecatonema clavatum S. and G.

Fig. 1. A section through a typical mature plant showing penetrating rhizoids from the basal layer, the clavate, sterile, erect filaments, and typical gametangia. × 250.

Fig. 2. The same as figure 1, but showing "ascocysts." × 250.

Fig. 3. A small fragment without rhizoids. × 125.

Fig. 4. A segment of the base at its margin. × 250.

Hecatonema Lawsonii S. and G.

Fig. 5. Two segments of the base showing frequent radial divisions of the cells. × 250.

Fig. 6. A young plant before any erect filaments have begun to develop. × 250.

Fig. 7. Typical gametangia and true hairs. × 250.

V. NEW SPECIES OF PYLAIELLA AND STREBLONEMA

Pylaiella tenella sp. nov.

Plate 42, figures 9–11

Frondibus late diffusis, simplicibus, 0.5–0.75 mm. altis, superne longe-attenuatis, non piliferis, per filamenta curta, ramosa, contortaque affixis; cellulis 7–10μ diam., 1–2.5-plo. longioribus quam latis; chromatophoris juvenis, singulis, interrupto-taeniatis, cellulam fere implentibus, ultimo in frustis distinctis separantibus; zoosporangiis longe-catenatis subterminalibus, cellulis numerosis assimilatoribus in seriebus per divisiones longitudinales zoosporangiis bina aut quaterna formantibus; gametangiis subterminalibus.

Growing on *Pleurophycus Gardneri* Setchell and Saunders, the plants forming minute tufts, which later become confluent. Neah Bay, near Cape Flattery, Washington. Type, Gardner, no. 3818 (Herb. Univ. Calif., no. 207010), May.

This species of *Pylaiella* is the most diminutive of all the known species of the genus, rarely attaining the length of one millimeter, its nearest rival, in this respect, being *P. nana* of Kjellman, from the Norwegian Polar Sea. It differs from that species in size, being only about one-half as large, in not being branched, in having subterminal gametangia in a long series, instead of terminal branched ones as described and figured by Kjellman for *P. nana* and in having double and quadruple zoosporangia formed by longitudinal and cross divisions of fructiferous cells. We have also observed this condition highly developed in forms of *P. littoralis*. Double zoosporangia have been observed by Börgesen (1920, p. 433) in *P. fulvescens* (Schousb.) Bornet from the Danish West Indies. It evidently belongs to the Panthocarpus group of the genus as established by Skottsberg (1915, p. 158). The gametangia are formed by the transformation of vegetative cells, usually beginning relatively few cells back of the apices of the filaments, a considerable number of cells transforming simultaneously. The transformation continues in both directions until one-half to three-fourths of the filament is converted into gametangia. They vary greatly in size, some producing as many as thirty-two loculi from a single assimilating cell. They may be continuous or discontinuous, certain assimilating cells in the series not being transformed. The cell walls in the formation of loculi frequently are quite oblique.

Zoosporangia occupy very much the same position in the filaments as the gametangia. They are subterminal, long-catenate, but seem to be formed more nearly simultaneously than are the gametangia.

These plants are quite abundant on the blade of the host-plant at Neah Bay. We have not observed it growing elsewhere, although the host is abundant in the vicinity of the Strait of Juan de Fuca. They are, however, very inconspicuous, forming small, more or less continuous expansions, barely recognizable when the host plant is wet.

Pylaiella unilateralis sp. nov.

Plate 42, figures 6–8

Filamentis erectis per filamenta repentia, irregularia, plus minusve ramosa affixis, floccosis, leviter clavatis, 4–7 mm. altis, basi 19–22μ diam., apicali 28–32μ diam., ramis inferne plerumque alternis sparsisque, superne secundis, e cellulis 1–2-plo longitudinaliter divisis oriendis; cellulis 2–2.5-plo longioribus quam latis, basi cylindricis, superne plus minusve quadratis doliiformibusque; chromatophoris tenuibus, irregulariter taeniatis et plus minusve connectis; zoosporangiis eodem tempore maturantibus, 7–12-catenatis, in ramulis plerumque terminalibus, sphaeroideis, 24–28μ diam.; gametangiis ignotis.

Growing on rocks in shallow pools, near high-tide limit. Sunset Beach, near the mouth of Coos Bay, Oregon. Type, Gardner, no. 2748 (Herb. Univ. Calif., no. 207011), May, 1914.

The second branching, together with the longitudinal divisions of the cells from which the second branches arise forming a polysiphonous region are the chief distinguishing characteristics of this species. The branching below is sparse, alternate or very rarely opposite, and the branches are relatively long and attenuated. These branches may give rise to terminal zoosporangia, or to a few short alternate ramuli which in turn produce the zoosporangia. Many of the main filaments become slightly enlarged toward their outer ends, the cells becoming nearly quadrate, their walls thickened, and their contents very dense. An average of about thirty-five cells, though frequently as many as sixty-five, are thus transformed. A few cells of the ends of the filaments are not transformed and soon disintegrate, thus producing a distinctly clavate filament. The region of transformation seems to be a new meristem of a peculiar nature. Many of the cells divide once or, less frequently, twice, by longitudinal planes as a rule, but occasionally the dividing planes are at right angles separating the cell into four parts. The unique feature resulting from these divisions is the lack of further growth of the cells. Usually one

of the cells resulting from longitudinal division gives rise to a branch, shorter or longer, but similar to branches arising in the regular manner. The branches are typically secund, but may rarely come from the opposite side of the filament. Many of the main filaments become much curved in this branching region.

Streblonema Porphyrae sp. nov.

Plate 44, figure 6

Frondibus plerumque endophyticis; filamentis prostratis maxime tortuosis, inter parietes cellularum hospitis penetrantibus, copiose ramosis; filamentis erectis ultra superficiem hospitis leviter protrudentibus, passim ramosis; filamentis piliferis ignotis; cellulis filamentorum repentium 3–4μ diam., forma irregularibus; zoosporangiis ignotis; gametangiis filamenta erecta terminantibus, ultra superficiem hospitis leviter protrudentibus, forma fusiformibus ad irregularibus, 25–35μ longis, 5–8μ latis.

Growing in the parenchymatous base of *Porphyra naiadum* on eelgrass. Pacific Grove, California. Type, Gardner, no. 4686 (Herb. Univ. Calif., no. 207008), December.

Streblonema Porphyrae is an exceedingly diminutive, though apparently distinct, species, confined, so far as we know at present, to the cushion-like bases of *Porphyra naiadum*. It ramifies deep into the tissue, apparently not entering the cells.

Streblonema myrionematoides sp. nov.

Plate 44, figure 7

Frondibus microscopicis; partibus prostratis exiguissime evolvatis, inter strata duo aut tria externa cellularum hospitis leviter penetrantibus; filamentis erectis plus minusve ad superficiem hospitis fasciculato-ramosis; 65–80μ longis, plerumque fructuosis, pilis exiguis; cellulis filamentorum penetrantium 4–5μ diam., forma irregularibus; zoosporangiis ignotis; gametangiis numerosis, cylindricis, 50–65μ longis, 4.5–6.5μ latis; loculis uniseriatis.

Growing on the blade of *Laminaria Andersonii*. Moss Beach, San Mateo County, California. Type, Gardner, no. 4622 (Herb. Univ. Calif., no. 207005), July.

It is an extremely perplexing problem to decide upon the generic position of forms such as the one we have named and described above. It has close affinities with the three genera, *Streblonema*, *Ectocarpus*, and *Myrionema*. The erect fronds exterior to the host and more or less branched, with relatively scanty attaching portions, constitute the

vegetative portion of an *Ectocarpus* of microscopic size. The gametangia are strictly those of a typical *Myrionema*, but it lacks the disk-shaped basal layer of filaments spreading out on the surface of the host, characteristic of that genus. The extremely reduced character of the penetrating portion does not speak well for the genus *Streblonema*. On the whole, we feel that with our present criteria for these genera it best agrees with the characters of the genus *Streblonema*, where we are placing it. It penetrates the uninjured host, but only to a slight depth. The plants, however, are usually so congested that their growth soon crowds the surface layer of the host cells to such an extent that they die and disintegrate, there being no evidence that the associate penetrates them and absorbs their material. The palisade-like stratum of gametangia suggests very strongly the *Myrionema* character which is the reason for the specific name.

Streblonema penetrale sp. nov.

Plate 44, figures 3, 4

Frondibus stratum continuum pulvinatumque forma magnitudineque indefinitum supra stipitem hospitis formantibus; parte penetrante, filamentis parce ramosis in hospitem comparate profundi penetrantibus et ad superficiem hospitis perpendicularibus composita; filamentis erectis ad superficiem hospitis fasciculato-ramosis, 70–125μ longis, supra leviter attenuatis, non piliferis; cellulis filamentorum penetrantium cylindricis ad irregularibus, 6.5–8μ diam., 3–5-plo longioribus; cellulis filamentorum erectorum cylindricis ad leviter doliiformibus, 6.5–8μ diam., 1.5–2.5-plo longioribus; chromatophoris taeniatis; zoosporangiis ignotis; gametangiis cylindricis usque ad obtuse-fusiformibus, plus minusve irregularibus, 30–40μ longis, 8–11μ latis; loculis uniseriatis.

Growing on the stipes of *Hesperophycus Harveyanus*. Pacific Grove, California. Type, Gardner, no. 4677 (Herb. Univ. Calif., no. 207007). December.

Streblonema penetrale, like *S. myrionematoides* above, is a difficult species to classify. In its method of development and general structure it approximates to *S. myrionematoides* closely. The penetrating portion is much more highly developed than in that species, extending into the host among the cells to a depth of four or five times as great as the part which extends beyond the surface. The size of all the parts is, in general, greater than in *S. myrionematoides*. No horizontal filaments are present. The penetrating filaments are mostly perpendicular to the surface.

Streblonema vorax, sp. nov.

Plate 44, figures 1, 2

Frondibus microscopicis, filamentis prostratis profuse ramosis, maxime tortuosis, inter cellulas epidermales hospitis penetrantibus, in interiore hospitis diffundentibus et cellularum parenchymaticarum parietes dissolventibus, easdem complentibus, et earum partem interiorem devorantibus; cellulis 6–10μ longis, 5–8μ latis; filamentis erectis 400–600μ longis, 6.5–8μ diam., superne in pilis attenuatis, ad aut prope superficiem hospitis fasciculato-ramosis, massam compactam cellularum formantibus; zoosporangiis late clavatis, 60–100μ longis, 15–30μ latis; gametangiis numerosis, lateralibus, sessilibus aut pedicellis brevibus suffultis, anguste cylindricis, obtusis, 40–70μ (ad 100μ) longis, 7–9μ latis; loculis plerumque uniseriatis.

Growing on the outer ends of the leaves of eel-grass, in the lower littoral and upper sublittoral belts. Sitka, Alaska. Type, Gardner, no. 3968*b* (Herb. Univ. Calif., no. 207003), July.

Of all the species of *Streblonema* thus far discovered on our coast, *S. vorax* is the most destructive to the host. Although the penetrating filaments have abundance of chromatophores, the plants seem to be in a large degree parasitic. The cells of the host are closely compacted, and have thick walls, yet they are devoured in large quantities. We suggest the possibility of the secretion of enzymes with digestive power which act upon the cell wall and its protoplasm, after which they are absorbed. This plant is found in company with several other small Melanophyceae, Chlorophyceae, and Rhodophyceae, none of which penetrate the host.

Streblomena scabiosum sp. nov.

Plate 44, figure 5

Frondibus pustulas rotundas aut ellipticas magnitudine indefinatas in superficie hospitis formantibus; partibus penetrantibus filamentis copiose ramosis primo inter cellulas penetrantibus et eas necantibus, ultimo interiorem cellularum occupantibus et eversionem totam efficientibus; filamentis erectis supra superficiem hospitis extendentibus, aut simplicibus aut plus minusve basi fasciculato-ramosis, 50–80μ altis; cellulis filamentorum repentium forma magnitudineque maxime irregularibus; cellulis filamentorum erectorum cylindricis, 4.5–5.5μ diam., 1–2.5-plo longioribus; chromatophoris taeniatis; zoosporangiis ignotis; gametangiis cylindricis, sessilibus aut brevi-pedicellatis, supra superficiem hospitis extendentibus, 40–60μ longis, 4.5–6μ latis.

Growing on the stipe of *Nereocystis Luetkeana*. Cast ashore near the "Cliff House," San Francisco, California. Type, Gardner, no. 4628 (Herb. Univ. Calif., no. 207006), August.

Streblonema scabiosum forms marked scrofulous-like areas on the lower part of the stipe of the host. It has a disastrous effect upon the host, destroying its cells as far as it penetrates, and seems constantly to spread by new infections around the margin of the affected area. The cause of the death of the cells of the host has not been investigated. In habit of growth and general form the species seems related to *S. myrionematoides* and to *S. penetrale*.

Streblonema evagatum sp. nov.

Plate 42, figures 1–5

Frondibus maculas orbiculares 1–2 cm. diam. formantibus; filamentis repentibus irregularibus, multe ramosis, inter bases sporangiorum hospitis penetrantibus; filamentis erectis fasciculato-ramosis, plerumque in hospite submersis, ad apicem basimque levissime attenuatis, 190–230μ altis; cellulis filamentorum repentium 3.5–4μ diam.; cellulis filamentorum erectorum basim 4μ diam., 2–3.5-plo longioribus, in parte latissimo 6.5–7.5μ diam., 1–2-plo longioribus, cylindricis, ad dissepimenta leviter constrictis; chromatophoris taeniatis, in cellula quaque 1–2; zoosporangiis ignotis; gametangiis numerosis, cylindricis, lateralibus, sessilibus aut in pedicellis curtis suffultis, 65–80μ longis, 5.5–6.5μ latis; loculis uniseriatis.

Growing in the blades of *Laminaria Andersonii*, upper sublittoral belt. Cypress Point, Monterey County, California. Type, Gardner. no. 4688 (Herb. Univ. Calif., no. 207009), December.

This species has a habit of growth very similar to that of *Streblonema pacificum*, but the plants cover much more extensive areas which are quite certainly not infested by a single plant, as may be the case in that species. Their presence seems to affect the host materially, to a large extent destroying its sporangia and causing discoloration. It is possibly partially parasitic.

Streblonema rugosum sp. nov.

Plate 43, figures 5–7

Frondibus microscopicis in superficie hospitis areas rugosas extensas efficientibus; filamentis repentibus inter cellulas superficiales hospitis penetrantibus et filamenta erecta, fasciculato-ramosa, fructifera et pilifera emittentibus; cellulis filamentorum et erectorum et repentium forma magnitudineque irregularibus; chromatophoris taeniatis; zoosporangiis ignotis; gametangiis obtuse fusiformibus, in filamentis erectis plurimis terminalibus, 18–24μ longis, 5–6.5μ latis; loculi uniseriatis, in serie longitudinali quaque 4–6.

Growing on the blade of *Alaria tenuifolia.* Friday Harbor, Washington. Type, Gardner, no. 4041 (Herb. Univ. Calif., no. 207004), July.

This species, like *Streblonema myrionematoides* and *S. scabiosum,* has the larger part outside of the host. It penetrates to a considerable depth among the cells of the uninjured host, later apparently mechanically causing the death of a few surface cells and an abnormal growth of others, giving to the surface a rugose appearance. The plants seem to associate in small groups of indefinite shape and size, often confluent and, although small, can readily be detected by the peculiar appearance they give to the host.

Streblonema transfixum sp. nov.

Frondibus maculas 5–8 mm. diam. formantibus; filamentis repentibus inter cellulas hospitis profunde penetrantibus, distortis, irregulariter ramosis, 4–5μ diam., filamenta dispersa, curta erecta, eramosa, e superficie hospitis protusa et a gametangiis terminata emittentibus; cellulis filamentorum erectorum cylindricis, 7–9μ diam., 0.75–1.5-plo longioribus; chromatophoris taeniatis, parietem cellulae proxime tegentibus; zoosporangiis ignotis; gametangiis cylindrico-conicis, obtusis, 40–60μ longis, 8–12μ latis; loculis 1–2-seriate.

Growing on *Desmarestia ligulata* f. *herbacea.* San Pedro, California. Type, Gardner, no. 1992a (Herb. Univ. Calif., no. 207001), September.

Streblonema transfixum, here described, forms definite, discolored areas on the surface of the host, readily detectable. The species is described from dried material. The cells of the host are much collapsed and do not straighten out when soaked and boiled, hence the details of the species are not so thoroughly and satisfactorily presented as is desirable. The plants penetrate among the cells of the host and seemingly pass clear through it. Just how much constitutes a single plant cannot at present be made out.

Streblonema corymbiferum sp. nov.

Plate 43, figure 8

Frondibus microscopicis, filamentis irregulariter alterne ramosis et inter cellulis hospitis penetrantibus compositis, ramulis fructiferis plane aggregatis, fasciculos corymbiformes prope superficiem hospitis formantibus; cellulis plerumque cylindricis, pro parte irregularibus, 4–5μ diam., 1.5–4-plo longioribus; chromatophoris taeniatis, parietem cellulae non tegentibus; zoosporangiis ignotis; gametangiis cylindricis

usque ad leviter fusiformibus, obtusis, in pedicellis curtis suffultis aggregatis aut in filamentis repentibus prope superficiem hospitis sessilibus, 25–35μ longis, 4.5–5.5μ latis; loculis uniseriatis, septis plerumque obliquis.

Growing on *Cumagloia Andersonii* (Farlow) S. and G., in company with *Streblonema anomalum* and *S. Johnstonae*. San Pedro, California. Type, Mrs. H. D. Johnston, no. 115*a* (Herb. Univ. Calif., no. 94663), August.

While studying the material of *Nemalion Andersonii* Farlow, collected by Mrs. H. D. Johnston at San Pedro, California, in 1899 and deposited in the Herbarium of the University of California under no. 94663, some specimens of Ectocarpaceae were incidentally observed. When we came to study our material of this family, these specimens were given careful scrutiny with the result that three species new to science were detected on a single specimen of the host, viz., *Streblonema corymbiferum*, *S. anomalum*, and *S. Johnstonae*, all of which are presented for the first time in this paper.

The habit of each and the size of all the parts are so characteristic that, notwithstanding their intimate association on the same host, they can readily be distinguished. *S. corymbiferum* is the most delicate of the three. The very frequent grouping of the gametangia into corymb-like clusters is one of the most prominent distinguishing characters of the species. Other species of this genus are as small or even smaller. In size of parts, somewhat in habit and in habitat, it resembles *S. minutissimum* Saunders, found growing at Sitka, Alaska, on "*Liebmannia* sp." (Saunders, 1901, p. 416).

Streblonema anomalum sp. nov.

Plate 43, figures 1–3

Frondibus microscopicis, plus minusve confluentibus; filamentis partis prostratae inter cellulas hospitis penetrantibus moderate et irregulariter ramosis, multe contortis, usque ad 16μ diam.; filamentis erectis simplicibus, plerumque cylindricis, pro parte obtusis et pro parte piliferis, 200–250μ longis, ultra superficiem hospitis extendentibus; filamentis piliferis sparsis, e filamentis repentibus oriundis; cellulis filamentorum repentium plus minusve in partibus senilibus 1–2-plo longitudinaliter divisis, filamentum polysiphoneum producentibus, 18–24μ diam.; cellulis alteris forma leviter irregularibus, 8–11μ diam., admodum ad dissepimenta leviter constrictis; cellulis filamentorum erectorum cylindricis, 8–9μ diam., quadratis; chromatophoris singulis, taeniatis, in filamentis erectis continuis, in filamentis repentibus plus minusve interruptis; zoosporangiis ellipsoideis, ovoideis

aut proxime sphaericis, 40–60μ longis, 28–35μ latis, in filamentis repentibus sessilibus; gametangiis cylindrico-conicis, plerumque obtusis, 50–100μ longis, 10–16μ latis, sessilibus aut in filamentis repentibus longe-pedicellatis singulis aut secundis.

Growing in *Cumagloia Andersonii* (Farlow) S. and G. in company with *Streblonema corymbiferum* and *S. Johnstonae*. San Pedro, California. Type, Mrs. H. D. Johnston, no. 115*b* (Herb. Univ. Calif., no. 94663), August.

Streblonema fasciculatum Saunders, Phyc. Mem., 1898, p. 148 (not of Thuret).

Examination of a small piece of authentic material of *S. fasciculatum* Saunders collected at San Pedro, California, in August, 1896, revealed the presence of specimens of the same three species mentioned under *S. corymbiferum* of this paper, collected by Mrs. Johnston at the same place and in the same month. *S. anomalum* is undoubtedly the one to which Saunders refers as *S. fasciculatum* Thuret. It does not seem, however, to be this species, if we have a correct conception of what *S. fasciculatum* Thuret includes. This species was published in Le Jolis, Algues marines de Cherbourg, no. 100, and in Liste, 1863, p. 73. Thuret quotes as a synonym, *S. volubilis* Pringsheim (Beitr. Morph. Meeres Alg., p. 13, plate 3, fig. B, read in 1862). Pringsheim's figure of *volubilis* shows the gametangia fasciculately branched, and he states that this character is one of the chief characters of the genus *Streblonema*. This figure has been much quoted since. He gives no measurements of the parts, neither does Thuret.

Reinke (Algenfl., 1889, p. 41) recognizes *Streblonema* as a subgenus of *Ectocarpus*. He recognizes Pringsheim's plant, quoting the above figure, but since *volubilis* was already occupied by Crouan (1867, p. 161) and *fasciculatum* was occupied by Harvey (Phyc. Brit., pl. 273), he renamed the plant, calling it *Pringsheimii*. Hauck (1884, p. 323) seems to have been the first to give measurements of the various parts of the plant. He lists it under *Streblonema*, cites the above literature of Thuret, and quotes *S. volubilis* Pringsheim. Considering Pringsheim's plant, recognized by Reinke and Hauck, as being the same as Thuret's, and taking Pringsheim's figure and Hauck's measurements as being correct for Thuret's *S. fasciculatum*, then our plant is distinct and undescribed.

There is a little doubt at present in our minds whether the plant we are here describing as *Streblonema anomalum* is one or two species. We do not find the filaments bearing the zoosporangia in the type

material examined to be like those figured by Saunders. His figures show the main filaments as being like those of all the known *Streblonemas*, monosiphonous, while those in both collections of material which we have examined are uniformly polysiphonous, that is, the cells of the main central parts of the thallus are all divided once or twice lengthwise. This never takes place in the plants which bear gametangia and which are intimately associated with them.

The measurements, method of branching of the two sets of plants, and their chromatophore characters are practically the same. At least two interpretations of this polysiphonous phenomenon appeal to us. They may represent a polymorphic state, in which a nonsexual plant differs in form from a sexual plant of the same species, a unique condition in the genus *Streblonema*, or the polysiphonous condition of the main filaments, found only in the nonsexual plants, may represent a character belonging to a wholly different genus, and hence it is a new species of that genus. Until a more extensive study of fresh material can be made, we feel that it is best to take the former view, and place it in a new and polymorphic species of *Streblonema*. We have amended the family Ectocarpaceae to include species with this polysiphonous condition.

Streblonema Johnstonae sp. nov.

Plate 43, figure 4

Frondibus microscopicis; filamentis repentibus moderate ramosis, ramis alternis aut oppositis, raro leviter secundis; filamentis erectis plerumque simplicibus, apice basimque leviter attenuatis, supra superficiem hospitis extendentibus, pro parte, brevi-piliferis; cellulis filamentorum primariorum repentium forma plus minusve variabilibus, plerumque doliiformibus, 12–18μ diam., 2.5–5-plo longioribus; cellulis filamentorum erectorum pro parte latissima usque ad 24μ diam., fere cylindricis, ad dissepimenta constrictis; chromatophoris tenuibus, parietalibus, in cellula quaque singulis, parietes cellularum fere tegentibus; zoosporangiis ignotis; gametangiis conicis usque ad inaequaliter fusiformibus, 90–130μ longis, 28–36μ latis, plerumque brevipedicellatis in filamentis prope superficiem hospitis repentibus positis.

Growing in *Cumagloia Andersonii* (Farlow) S. and G. in company with *Streblonema corymbiferum* and *S. anomalum*. San Pedro, California. Type, Mrs. H. D. Johnston, no. 115*c* (Herb. Univ. Calif., no. 94663), August.

Of the three plants found ramifying among the filaments of the host mentioned above, *Streblonema Johnstonae* is the most robust in all

of its parts. It can readily be distinguished from the other two species with which it is associated by the large size of the gametangia. No zoosporangia have been observed. We take pleasure in dedicating this species to Mrs. H. D. Johnston, who collected the host and donated it to the Herbarium of the University of California with several other interesting forms from San Pedro, California.

Streblonema aecidioides f. **pacificum** forma nov.

Plate 44, figures 8, 9

Frondibus microscopicis, supra superficiem hospitis ut maculas elevatas 75–150μ diam. notatis; parte vegetativa stratum plus minusve parenchymaticum exigue infra stratum superficiale hospitis positum et infra filamenta pauca radiciformia in hospitem profundiore penetrantia emittens formantibus; filamentis erectis omnibus fructiferis filamentis paucis, piliferis in centro frondis positis exceptis; cellulis filamentorum piliferorum 4–5.5μ diam., inferne quadratis, superne 5–8-plo longioribus, evaginatis; zoosporangiis(?) anguste clavatis, sessilibus, 22–28μ longis, apice 8–12μ latis; gametangiis numerosis, dense aggregatis, cylindricis, in strato prostrato sessilibus, 45–55μ longis, 5–6.5μ latis; loculis uniseriatis.

Growing within the lamina of *Hedophyllum sessile* (Aresch.) Setchell, near the outer end. Neah Bay, Washington. Type, Gardner, no. 3866*a* (Herb. Univ. Calif., no. 207002), May.

Streblonema accidioides f. *pacificum* seems very closely related to the *Ectocarpus accidioides* of Rosenvinge (1893, p. 894), found growing in Greenland on *Laminaria longicruris and L. Groenlandica.* It differs only in minor details as to the dimensions of the parts. Regarding the zoosporangia we have to speak with uncertainty. As figured by Rosenvinge, the Greenland plant has them well developed and producing zoospores. They are in distinct "aecidia" and apparently on distinct nonsexual plants. In our species they likewise appear to be on nonsexual plants. In ours there is no indication of the production of zoospores. They are possibly too young, or possibly they are abortive organs so commonly met with in various other genera on our coast, the nature of which is still an open question. This form seems to enter the host from the surface and after penetrating to the second layer of cells spreads out horizontally between the surface layer and the second layer. Later, filaments arise from the under side of this layer and penetrate among the cells of the host, apparently never entering them. Finally from the upper surface each cell in the central region of the layer gives rise to a filament and the mass acting together

lifts up the surface layer of cells of the host, forming a small blister which finally ruptures, as in the case of Rosenvinge's plants. The erect filaments are almost simultaneously transformed into gametangia, except a few in the center which develop into hairs.

Foslie (1894, p. 167, 23 in reprint) describes forms of the same species found growing on *Laminaria saccharina* at Kjelvik and at Lyngø near Tromsø, Norway. These he listed under *Ectocarpus* (*Streblonema*) *accidioides* Rosenvinge. The measurements of the parts of his forms average, in general, a little larger than those of Rosenvinge. De-Toni (1895, p. 577) cites these Arctic plants under *Streblonema accidioides* Rosenv. Foslie gives 80μ as the extreme length of the gametangia.

Streblonema investiens (Collins) comb. nov.

Fronds occupying indefinite areas on the host; creeping filaments irregularly branched, often curving outward and bearing on the outside short, simple, or sparsely branched filaments; hairs sparse; cells of creeping filaments 5–8μ diam., 1–2 (up to 4) times as long, swollen, or cylindrical; cells of the ramuli 6μ diam., 1–2 times as long; cells of the hairs 8μ diam.; chromatophores discoid, small, several in a cell; zoosporangia ovoid, sessile or on 1-celled pedicels on both the creeping filaments and the ramuli, 20μ long, 15μ broad; gametangia cylindrical, 25–40μ long, 8–10μ broad; loculi mostly uniseriate, gametangia and zoosporangia growing on the same plant.

Growing in the fronds of *Helminthocladia calvadosii* (Lamour.) Setchell. San Pedro, California. July.

Strepsithalia investiens Collins, *in* Collins, Holden, and Setchell, Phyc. Bor.-Amer. (Exsicc), no. 738.

It seems that the chief distinction between the genera *Strepsithalia* Sauvageau and *Streblonema* Derb. and Sol. is the secretion by *Strepsithalia* of a rather copious gelatinous sheath investing the entire plant, particularly the exposed portions, the ramuli. Since we are not able to demonstrate the presence of such a sheath, even to the slightest degree, we have thought it best to place Collins' *Strepsithalia investiens* in the genus *Streblonema*.

VI. NEW SPECIES OF ECTOCARPUS

Since the publication of our account of the Algae of Northwestern America (1903), more or less extensive search and study has been carried on in that same region as well as farther south along the whole coast of North America, with the result that a considerable number of forms of Ectocarpus have been discovered and much more data on previously known forms have been brought to light, necessitating some changes in our previous account and particularly necessitating the founding of several new and quite distinct species. We do not imagine that the field has been, by any means, thoroughly investigated, but we are publishing these findings up to date hoping to stimulate further investigation. Doubtless there are many more undiscovered species and certainly much remains to be worked out regarding life-histories of the various known species. The "megasporangia," "meiosporangia," and "antheridia" of Sauvageau (1896, 1896*a*, 1896*b*, 1896*c*) offer further and attractive subjects for investigation in the reproductive phase of this group. The nature of the "zoosporangia" or "unilocular sporangia" and the position of the plants which bear them in the life cycle is a matter concerning which but little is known, and which deserves critical study.

For the sake of uniformity in the method of grouping, in our Pacific coast algological studies, we have found it necessary to name a new Order for use in our forthcoming Part III, the Melanophyceae, of our 'Marine Algae of the Pacific Coast of North America.' The following diagnosis, here published for the first time, sets forth our conception of the group.

Ectocarpales nom. nov.

Confervoid (monosiphonous) or solid Phaeosporeae of varying dimensions, habit, and complexity, typically possessing unilocular zoosporangia and plurilocular gametangia and with no portion of the cell membranes turning black with *eau de Javelle;* growth in length strictly apical, subapical ("trichothallic"), or more or less intermediate between typical forms of either; both unilocular zoosporangia and plurilocular gametangia rarely on the same individual in some species, but, most commonly, borne on different individuals, thus pointing to an alternation of generations, reduction division taking place in the primary nucleus of the unilocular zoosporangia, at least in some species; gametophyte and sporophyte practically indistinguishable as to size and complexity.

Ectocarpaceae Oltmanns, Morph. und Biol. der Alg., vol. 1, 1904, p. 350 (pro parte majore).

It seems more consistent with the present usage in other subclasses of the Thallophyta, to consider the extended Ectocarpaceae of Oltmanns as an Order rather than as a Family. While the families under it present a very considerable variety in the details of structural differences, they have in common the possession of plurilocular gametangia and an identity in size and structure of both gametophyte and sporophyte. The Ectocarpales are closely related to the Cutleriales, but in the latter there are some decided differences between the two generations. From the Sphacelariales, the Ectocarpales differ in the absence of the conspicuous apical cell and the very different cell wall. The cell wall, or the older layers of it, changes to black in the Sphacelariales when treated with *eau de Javelle*, but does not show this reaction in any of the Ectocarpales. The Laminariales are to be distinguished from all the other orders of the Phaeosporeae by their intercalary region of longitudinal growth in connection with their mierosecpic gametophyte. The existence of a reduced gametophyte in the Dictyosiphonales separates them also from the Ectocarpales.

Ectocarpus acutus nom. nov.

Plate 48, figures 36–39, and Plate 49, figures 40, 41

Frondibus 5–9 cm. altis, saturate fuscis, vivo olivario-viridibus, plumosis; filamentis erectis, inferne plus minusve intricatis fasciculatisque, superne liberis, profuse ramosis, filamentis primariis corticatis; ramis plerumque alternis, strictis; ramulis ultimis plerumque secundis, acute subulatis; cellulis leviter doliiformibus, 40–60μ diam., 0.4–2-plo longioribus quam latis (vulgo brevioribus quam latis); chromatophoris crassis, irregulariter ramosis, in cellula quaque paucis, pyrenoideas (plures) exhibentibus; zoosporangiis ignotis; gametangiis numerosis et regulariter dispositis, cylindrico-conicis, 100–150μ (usque ad 230μ) longis, 20–35μ latis.

Growing, for the most part at least, on larger Melanophyceae. Puget Sound to central California (Carmel).

Ectocarpus penicillatus Saunders, Phyc. Mem., 1889, p. 155, pl. 21, figs. 3, 4 (not of Kjellm.). *Ectocarpus confervoides* f. *acuminatus* Collins, *in* Setchell and Gardner, Alg. N.W. Amer., 1903, p. 237, Mar. Alg. Vancouver Is., 1913, p. 106; Collins, Holden, and Setchell, Phyc. Bor.-Amer. (Exsicc.), nos. 1033, 1127.

The type of the species is no. 2886, Gardner (Herb. Univ. Calif., no. 206991), collected at Carmel, California, in May, 1915, and grow-

ing on a form of "*Desmarestia ligulata.*" It seems to be the same as the plant figured (and described) by Saunders (*loc. cit.*) under *Ectocarpus penicillatus.* It is undoubtedly the same plant as that described by F. S. Collins under the name *E. confervoides* f. *acuminatus* which was founded on no. 235, Gardner (Herb. Univ. Calif., no. 99022) collected at Whidby Island, Washington, growing on a broad form of *Desmarestia.* Its affinities are closely with *Ectocarpus confervoides* f. *typicus,* but it has shorter cells, sharper ramuli, decidedly constricted filaments, with the gametangia more inclined toward cylindrical than is general in that form. The chromatophores are more distinctly band-shaped and more separated from one another than in *E. confervoides.*

A few small but profusely fruiting specimens of plants seemingly of this species have been found growing on *Mesogloia Andersonii* at Neah Bay, Washington (Gardner, no. 3817). These were attached to the host by means of penetrating rhizoidal filaments, particularly by the descending corticating filaments. The specimens differ from the typical form in that they are smaller, the gametangia are shorter and blunter, and on separate individuals occur seriate zoosporangia(?), some of which are divided longitudinally into four loculi. Further study of more material will be necessary to determine the status of this form. For the present we are placing it with *E. acutus.* The gametangia are represented on plate 49, figure 41, and the zoosporangia on plate 49, figure 40. The zoosporangia are very numerous, and they resemble in form those figured by Sauvageau (1896*b*, p. 33, reprint) for *Ectocarpus virescens.* They, however, have a glistening appearance, as though they were abortive or in a pathological condition, while those represented by Sauvageau are producing zoospores. This condition in which we find ours is quite common among our Pacific Coast species of *Ectocarpus.* We have not yet seen a single specimen in which the so-called seriate zoosporangia show any indication of producing zoospores.

Ectocarpus affinis sp. nov.

Plate 46, figures 16, 17

Frondibus minutissimis, 500–700μ altis, ad hospitem per filamenta rhizoidea pauca ramosa, decolorata, implicata affixis; filamentis erectis sparse ramosis, superne longe attenuatis, piliferis; ramis alternis aut oppositis; cellulis filamentorum primariorum cylindricis, basim 24–30μ diam., apice 9–11μ, in longitudine per filamentum totum variabilibus, 0.75–3-plo longioribus quam latis; chromatophoris parvis, tenuibus, in

cellulis juvenis, angulato-laminaeformibus, in cellulis vetustioribus fere regulariter discoideis; zoosporangiis ignotis; gametangiis lateralibus, plerumque sessilibus, interdum 1-cellulato pedicellatis, solitariis, secundis aut ad cellulam singulam verticillatis, obtuse-conicis usque ad sphaeroideis, 28–31μ longis, 25–28μ latis, per filamentum totam usque ad pilos terminales seriatis.

Growing on *Callithamnion* sp. Sitka, Alaska. Type, Gardner, no. 3961 (Herb. Univ. Calif., no. 206998), July.

Two collections from Sitka, Alaska, but both made on the same day, show a small *Ectocarpus* growing on a species of *Callithamnion* which is so closely related to *E. ovatus* Kjellman (1877, p. 35) that perhaps it may seem necessary at some time to refer it to that species. The plants are, however, less stout than those of Kjellman and with more nearly spherical gametangia. For these reasons and because of its geographic remoteness and the somewhat different climatic conditions, we feel that it is desirable to describe the Alaskan plant as a distinct, but closely related species.

Ectocarpus chantransioides sp. nov.

Plate 48, figures 28–31

Frondibus e filamentis contortis repentibusque oriendis, pulvinulos densos hemisphaericosque, 4–8 mm. altos formantibus; ramis profusis, inferne alternis, superne plerumque secundis; filamentis primariis ramisque non attenuatis, apice crescentibus:: cellulis 8–10μ diam., inferne 2–3-plo longioribus quam latis, superne quadratis; chromatophoris taeniatis; zoosporangiis ignotis; gametangiis plerunque sessilibus, aut brevi pedicellatis, anguste cylindrico-conicis, 80–110μ longis, basim 16–20μ latis.

Growing on boulders in the lower littoral belt. Three miles northwest of Santa Monica, California. Type, Gardner, no. 2523 (Herb. Univ. Calif., no. 206988), November.

The habit of *Ectocarpus chantransioides* distinguishes it at once from all other species of the genus with the exception of *E. hemisphericus* Saunders. The latter species is always found, so far as our knowledge is concerned, epiphytic on Fucaceae, while the former species is confined to rocks. *Ectocarpus chantransioides* has also more slender filaments than has *E. hemisphericus*, not at all tapering, and has distinct apical growth. The gametangia are differently shaped, being longer and more slender. It is therefore very distinct even from *E. hemisphericus*. It resembles the genus *Choristocarpus* of the family Choristocarpaceae, as diagnosed by Kjellman (1897, pp. 190, 191), in

having apical growth. The growth in length of the erect filaments in Choristoearpaceae is by the division of the terminal cell only, whereas in *E. chantransioides* the meristem extends over a number of cells at the outer or apical end of the filaments. These cells, some 10 to 15 in number, are much richer in cell contents, the terminal cell being the richest of all in the series. This is a very unusual condition for an *Ectocarpus*. The nearly uniform diameter throughout of the erect filaments and their method of branching resemble to a remarkable degree those characters found in *Chantransia*. The gametangia are typically those of *Ectocarpus*, and notwithstanding the other rather unusual characters, it seems to be most closely related to that genus, but a very distinct species.

Ectocarpus commensalis sp. nov.

Plate 48, figures 32–35

Frondibus 200–400μ altis, dense fasciculatis, per filamenta rhizoidea intricata, parce ramosa inter utriculos et usque inter filamenta medullaria hospitis penetrantia affixis; filamentis erectis prope basim alterne ramosis, superne simplicibus et leviter attenuatis, non piliferis; cellulis filamentorum erectorum cylindricis, non constrictis, basim 12–18μ diam., 1.5–2.5-plo longioribus quam latis; chromatophoris taeniatis, in cellula quaque paucis; zoosporangiis ignotis; gametangiis obtuse fusiformibus usque ad cylindrico-conicis, brevi-pedicellatis, prope basim filamentorum plerumque lateralibus, raro terminalibus, 60–100μ longis, 15–20μ latis.

Growing on *Codium Setchellii* Gardner, Carmel Bay, and on *Codium fragile* (Suringar) Hariot, Pacific Grove, Monterey County, California. Type, Gardner, no. 3319 (Herb. Univ. Calif., no. 206994), May.

This minute species is one of several occurring on species of *Codium*, both on this coast and on that of southwestern Europe. The colorless rhizoidal filaments descend into the substance of the host even to the central (or basal) medullary tissues. The smaller diameter of the erect filaments and the more narrowly conical or fusiform gametangia readily distinguish this species from the others.

Ectocarpus eramosus sp. nov.

Plate 47, figures 18–23

Frondibus diffusis aut flocculosis, 1–3 mm. altis, per filamenta rhizoidea irregulariter ramosa inter utriculos hospitis profunde penetrantes affixis; filamentis erectis eramosis aut raro ramos breves,

divergentes vulgo in gametangiis terminantes emittentibus, basim et apice leviter attenuatis, non piliferis; cellulis filamentorum maturorum 28–40μ diam., 0.5–1.25-plo longioribus quam latis, cylindricis, levissime constrictis; chromatophoris comparate crassis, dense confertis, irregulariter taeniatis, sine pyrenoideis; zoosporangiis ignotis; gametangiis maxime magnitudine formaque variabilibus aut lateralibus et per filamenta tota alternis aut interdum in filamentis primariis terminalibus et seriatis plerumque pedicellis paucicellulatis, lateralibus cylindricis usque ad cylindrico-conicis, 150–230μ longis, 26–36μ latis, terminalibus seriatis, 700–900μ longis, 15–20μ latis.

Growing on *Codium fragile* in the lower littoral belt. Near the entrance to Tomales Bay, Marin County, California. Type, Gardner, no. 3448*b* (Herb. Univ. Calif., no. 206995), August.

This very small species has the general appearance of a form of *Ectocarpus confervoides*, but the cells are short and the filaments very slightly constricted at the partitions. It seems, in these respects, nearer to *E. acutus* and *E. corticulatus*, possibly bearing something of the same relation to these species that the dwarf forms of *E. confervoides* do to the typical form. *Ectocarpus eramosus*, however, is not readily to be referred as a dwarf form of either *E. acutus* or *E. corticulatus* and is consequently to be kept separate, at least for the present.

Ectocarpus flagelliferus sp. nov.

Plate 47, figures 25–27

Frondibus dense floccosis, 3–5 mm. altis, per filamenta pauca repentia et rhizoidea e cellulis inferis descendentia, decolorata affixis; filamentis erectis inferne simplicibus, superne sparse et alterne ramosis, superne longe attenuatis, inferne abrupte contractis, juvenis piliferis; cellulis filamentorum primariorum leviter doliiformibus, 25–35μ diam., 0.25–1.5-plo longioribus quam latis; chromatophoris parvis, irregulariter taeniatis aut laminaeformibus, pyrenoidis deuntibus; zoosporangiis ignotis; gametangiis magnitudine formaque variabilibus fusiformibus usque ad cylindrico-conicis, plerumque in pedicellis longis lateralibus, interdum in filamentis curtis erectisque terminalibus, aut in filamentis primariis longe-seriato-intercalaribus, lateralibus 125–200μ longis, 28–40μ latis, terminalibus et intercalaribus usque ad 1.5 mm. longis.

Growing on eel-grass. Sitka, Alaska. Type, Gardner, no. 3970 (Herb. Univ. Calif., no. 206999), July.

The species we have named *Ectocarpus flagelliferus*, while resembling superficially some of the shortest plants of *Ectocarpus confervoides* f. *variabilis*, presents several peculiarities which are characteristic. The plants of this species are attached, so far as the

adult specimens we have for study are concerned, by rhizoidal filaments which originate from several of the lower cells of the erect filaments and form complex basal masses which almost completely obscure the creeping filaments. Neither the rhizoidal filaments nor the creeping filaments, however, penetrate the host. The chromatophores are small and irregular in outline, seeming to be short bands rather than regular disks. They are generally so closely placed in the younger cells as to seem almost like a continuous band, but are separate in the older cells with slender processes almost connecting them to one another. The cells are short and the erect filaments and their branches extend out into long hairs like whip-lashes. The lateral gametangia are variable in shape, arranged much as in *Ectocarpus confervoides* f. *variabilis,* but are of different dimensions. Besides the characteristic *Ectocarpus*-type of gametangia which are lateral, there occur terminal seriate gametangia of the *Pylaiella*-type which reach an extreme length of 1.5 mm.

Ectocarpus flocculiformis sp. nov.

Plate 47, figure 24

Frondibus dense caespitosis, 0.75–1.5 mm. altis, per filamenta intertexta, penetrantia, rhizoidea affixis; filamentis erectis basi plus minusve furcatis, superne simplicibus aut in plantis, maximis, ramulis paucis, curtis, alternisque instructis, basi leviter attenuatis, superne longe attenuatis, non piliferis; cellulis cylindricis ad leviter doliiformibus, 20–25μ diam., 1–2.5-plo longioribus quam latis; chromatophoris numerosis, in cellulis junioribus angulato-discoideis, in vetustioribus rotundatis; zoosporangiis ellipsoideis, 56–66μ longis, 35–40μ latis, prope basim filamentorum erectorum in pedicellis curtis suffultis; gametangiis ovoideis ad ellipsoideis, numerosis, sessilibus aut brevi-pedicellatis, prope basim filamentorum erectorum lateralibus, 95–110μ (usque ad 150μ) longis, 30–45μ latis.

Growing on *Codium fragile,* the rhizoidal filaments penetrating deeply into the host, among and beyond the utricles. La Jolla, California. Type, Gardner, no. 3540 (Herb. Univ. Calif., no. 206996), December.

The nearest relative of *E. flocculiformis* apparently is *E. cylindricus* f. *codiophilus.* One marked difference between it and any of the forms of *E. cylindricus* is in the shape and size of the gametangia. This difference, along with others of less importance perhaps, though apparently constant, seems to be sufficient to warrant keeping it separate.

Ectocarpus fructuosus sp. nov.

Plate 45, figures 1–4

Frondibus floccosis, profuse et alterne ramosis, usque ad 2.5 cm. altis, per filamenta copiosa, repentia et comparate brevia affixis; filamentis erectis basi repetite furcatis, ramos longos ramulis ordinum duarum triumque brevibus obtusisque ubique circumdantes producentibus; cellulis filamentorum primariorum erectorum cylindricis usque ad leviter doliiformibus et parte ad dissepimenta constrictis, inferne 18–25μ diam., 2–4-plo longioribus quam latis, superne leviter latioribus brevioribusque; zoosporangiis ignotis; gametangiis numerosis, late conicis, sessilibus aut 1–3-cellulato pedicellatis, 50–70μ longis, basi 25–35μ latis.

Growing on the pneumatocyst of *Nereocystis Luetkeana*. Moss Beach, San Mateo County, California. Type, Gardner, no. 4568 (Herb. Univ. Calif., no. 207000), April.

Ectocarpus fructuosus comes within the *E. confervoides* group, but seems amply distinct from any known forms to constitute a species. This species is based upon the character of the branches, viz.; numerous long branches, producing throughout a great abundance of short, rather blunt ramuli, and upon the very numerous, rather short and blunt, predominatingly sessile gametangia. The species seems to be rare.

Ectocarpus granulosoides sp. nov.

Plate 45, figures 7, 8

Frondibus 2–3 cm. altis, profuse ramosis; filamentis primariis subdichotome ramosis, ramis omnibus basi abrupte attenuatis, inferne corticulatis; filamentis secundariis plerumque alternis, partim secundis, strictis, longe attenuatis, acutis, non piliferis, ramulis ultimis plerumque secundis, acutis; cellulis filamentorum primariorum 70–80μ diam., 0.5–1-plo longioribus quam latis, filametorum secundariorum 30–40μ diam., 0.3–1-plo longioribus quam latis, ramulorum ultimorum 14–20μ diam., 0.3–1.5-plo longioribus quam latis, omnibus ad dissepimenta leviter constrictis; chromatophoris numerosis, in cellulis vetustioribus discoideis, in cellulis ramulorum irregulariter angulosis; cellulis filamentorum cortieantum 7–10μ diam., 3–4-plo longioribus quam latis; zoosporangiis ignotis; gametangiis in latere superiore ramulorum ultimorum penultimorumque secundis, sessilibus, subfusiformibus, asymmetricis, 40–60μ longis, 12–20μ latis.

Growing on rocks(?). San Pedro, California. Type, Setchell, no. 1156*a*, December, 1895.

The very distinct species we have described under the name of *Ectocarpus granulosoides* has the habit of a small *E. granulosus* and

gametangia of the same general type as found in that species, but considerably smaller. The branching, however, is never opposite, and the acute ramuli gradually attenuated upward recall those of *E. acutus*, from which our species is amply distinct in both chromatophore and characters of its gametangia. The branches, particularly the larger, are very suddenly and considerably attenuated at the base, giving the species a striking characteristic of its own, at least within the group of species with discoid chromatophores.

Ectocarpus Mesogloiae sp. nov.

Plate 45, figures 5, 6

Frondibus minutis, 0.75–1.5 mm. altis, per filamenta copiosa, dense intertexta ramosa, rhizoidea, inter callulas hospitis penetrantia affixis; filamentis erectis sparse alterneque ramosis; filamentis primariis et ramulis superne longe attenuatis, acutissimis, non piliferis; cellulis cylindricis, ad dissepimenta leviter constrictis, basi 15–18μ diam., 1–2-plo longioribus quam latis, apicibus filamentorum 4–6μ diam.; chromatophoris tenuibus, irregulariter taeniatis, parietes cellularum fere tegentibus; zoosporangiis ignotis; gametangiis anguste cylindrico-conicis, 120–160μ (usque ad 210μ) longis, 18–22μ latis, brevi-pedicellatis, raro sessilibus.

Growing on *Mesogloia Andersonii*. Carmel Bay, Monterey County, California. Type, Gardner, no. 2865*a* (Herb. Univ. Calif., no. 206989), May, 1915.

The general characters of this diminutive species ally it with the *E. confervoides* group. We have deemed it best to consider it a distinct species on account of the small dimensions of all of its parts and its penetrating habit. It has not been seen on any other host except the one mentioned above.

Ectocarpus Saundersii sp. nov.

Frondibus floccos parvos 2–5 mm. altos formantibus, per filamenta copiosa, ramosa, in superficiem hospitis repentia affixis; ramis alternis; ramis primariis longis divergentibusque ramulis ultimis sparsis, brevibus, acuminatis; cellulis filamentorum primariorum 25–40μ diam., inferne quadratis, superne brevioribus, ad dissepimenta leviter constrictis; chromatophoris numerosis, discoideis; zoosporangiis breviter pedicellatis aut intercalaribus, globosis, ad 30μ diam.; gametangiis cylindricis usque ad ovoideis, obtusis aut acuminatis, lateralibus, pedicellis longioribus aut brevioribus suffultis, 70–150μ longis, 25–50μ latis.

Growing on *Fucus*, in the middle of the littoral belt. Pacific Grove, California.

Ectocarpus paradoxus var. *pacificus* Saunders, Phyc. Mem., 1898, p. 152, pl. 18, figs. 4–7; Collins, Holden, and Setchell, Phyc. Bor.-Amer. (Exsicc.), no. 530.

According to Saunders, his plant, the var. *pacificus*, differs from the type of *E. paradoxus* Mont., in lacking any manifestation of opposite branching as well as in having the gametangia longer and more pointed. In these respects and also in that it is a shorter plant, it seems to us to be sufficiently distinct to be separated specifically from the type, and to be different from any other species known to us. We are consequently dedicating it to its discoverer.

Ectocarpus simulans sp. nov.

Plate 45, figures 9–11

Frondibus 1–2 mm. altis, floccosis; filamentis prostratis tortuosis, diseretis; filamentis ereetis simplicibus, superne leviter attenuatis, non piliferis; cellulis cylindricis, ad dissepimenta non constrictis, medio 11–13μ diam., 1–2.5-plo longioribus quam latis; chromatophoris taeniatis, parietes cellularum prope exaete tegentibus, paucis; zoosporangiis ignotis; gametangiis lateralibus aut interdum terminalibus, sessilibus, anguste ellipsoideis, obtusis, plerumque leviter curvatis, 55–65μ longis, 15–20μ latis.

Growing on *Chaetomorpha aerea*. Cypress Point, Monterey County, California. Type, Gardner, no. 3087 (Herb. Univ. Calif., no. 206993). December.

The present speeies resembles, in general, eertain forms of *Ectocarpus pusillus* Griffiths (cf. Sauvageau, 1895), but the erect filaments are much more slender, usually never branched, and with much smaller gametangia. It forms tufts on *Chaetomorpha aerea*, whose filaments are encireled by the prostrate filaments of the *Ectocarpus* which form small cushions in their growth over one another. The gametangia are rather blunt and often more or less curved.

Ectocarpus socialis sp. nov.

Plate 46, figures 12, 13

Frondibus caespitosis, 1–3 mm. altis, per filamenta rhizoidea dense intricata et penetrantia affixis; filamentis erectis, ad superficiem hospitis, repetite furcatis, superne simplicibus aut alternate-ramosis, longe attenuatis et piliferis; cellulis cylindricis usque ad leviter dolii-

formibus, non constrictis, 22–28μ diam., inferne 1–2-plo, superne 1–2-plo longioribus quam latis; chromatophoris parvis, in cellula quaque paucis, discoideis; zoosporangiis ellipsoideis, erectis, lateralibus, alternis 1–2-cellulato-pedicellatis, interdum prope basim filamentorum erectorum sessilibus, 60–95μ longis, 35–50μ latis; gametangiis fusiformibus, sparsis, partes superiores filamentorum erectorum occupantibus, sessilibus aut 1–2-cellulato-pedicellatis, alternis 70–85μ longis, 25–30μ latis.

Growing on *Codium fragile* (Suringar) Hariot, in company with *Ectocarpus globifer* Kuetz. and with various species of Myxophyceae and Rhodophyceae. Redondo, California. Type, Gardner, no. 1947*b* (Herb. Univ. Calif., no. 206987), March.

Ectocarpus socialis seems to be a relative of the *E. cylindricus* group. The chief distinctions are in the shape, size, and position of the gametangia.

Ectocarpus Taoniae sp. nov.

Plate 46, figure 15

Frondibus diffusis, 0.5–1.5 mm. altis, per filamenta superficialia repentia, profuse ramosa affixis; filamentis erectis simplicibus, basim leviter attenuatis, superne longe attenuatis, piliferis; cellulis filamentorum repentium cylindricis, 4–6μ diam., filamentorum erectorum 8–10μ diam., inferne quadratis, apicibus 4–6-plo longioribus quam latis; chromatophoris curtis, comparate crassis, irregulariter taeniatis; zoosporangiis ignotis; gametangiis anguste ellipsoideis, interdum lente curvatis, in filamentis repentibus et erectis plerumque sessilibus, 20–28μ (usque ad 40μ) longis, 15–20μ latis.

Growing on *Taonia Lennebackerae*. San Pedro, California. Type, Gardner, no. 3561*a* (Herb. Univ. Calif., no. 206997), December.

This species forms rather diffuse and even layers, mostly along the margins of *Taonia*, over whose surface the creeping filaments spread and give rise to gametangia or to erect filaments not over 1.5 mm. high. In many ways it seems like a miniature *Ectocarpus Padinae* (Buffh.) Sauvageau (1897, p. 30 *et seq.*). Our species, however, is only about half as tall, the cells of the erect filaments about half as broad, and the gametangia less than half as large as those of *E. Padinae*. We have found gametangia only of the "antheridium" type. *Ectocarpus Padinae* has its creeping filaments entirely endophytic while *E. Taoniae* has them entirely epiphytic.

Ectocarpus confervoides f. **parvus** (Saunders) comb. nov.

Fronds gregarious, forming tufted or extended masses, 1–2 cm. high, more or less alternately branched; erect filaments 21–30μ broad, slightly constricted at the joints, much attenuated at the tips or ending in hairs; cells 1–3 times as long as broad below, shorter above; chromatophores irregularly band-shaped; zoosporangia ovoid or ellipsoid, 35–55μ long, 20–27μ broad, usually sessile, sometimes on the same filament with the gametangia; gametangia narrowly lanceolate-conical, gradually long-attenuated above, 120–400μ long, 20–27μ broad, borne on a longer or shorter pedicel, occasionally seriate and intercalary (as in *Pylaiella*).

On sand-covered rocks (type!), logs, or on the larger Melanophyceae. Central California (near San Francisco) and southern California (San Pedro, the type locality, and San Diego).

Ectocarpus siliculosus parvus Saunders, Phyc. Mem., 1898, p. 153, pl. 22, figs. 1–9.

The f. *parvus*, as defined above, presents certain resemblances to both *Ectocarpus siliculosus* and *E. confervoides*. Its slender elongated gametangia resemble those of *E. siliculosus* and much might be said in favor of the opinion of Saunders in making it a "variety" of that species. On the other hand, very few, or none, of the typical gametangia end in a hair and we have therefore preferred to place it rather with *E. confervoides*. There are often found in this form, as well as in forms of *E. siliculosis*, very curious, elongated, intercalary gametangia which seem to be seriate in that they open laterally in sections, as do those of *Pylaiella*. Such gametangia are very puzzling, but may possibly be regarded as indicating hybridization between *Pylaiella* and *Ectocarpus* or a mutation of some sort. Speculation, however, can scarcely explain such anomalies. The majority of the gametangia are typically of *Ectocarpus* and while approaching in shape those of *E. siliculosus*, are less slender and less elongated than is typical for that species and are not ordinarily prolonged into terminal hairs.

So far as we may judge from the scanty specimen in our copy, no. 358 of Tilden's American Algae (from Pacific Grove) belongs rather under f. *parvus* than f. *variabilis*, although the determination as f. *variabilis* is attributed to Saunders.

Ectocarpus cylindricus f. **typicus** nom. nov.

Fronds diffused, 1–2 mm. high; creeping filaments superficial; erect filaments very sparingly branched above, several arising from the same creeping filament, tapering slightly at the base and apex; cells of the creeping filaments 16–20μ diam.; cells of erect filaments cylindrical, slightly constricted at the cross-walls, 2–3 times as long as broad below and at the apex, 0.5–1 times in the middle of the filament; gametangia mostly on the middle and upper parts of the filaments, mostly alternate.

Growing on *Egregia Menziesii, Halidrys dioica* and *Cystoseira osmundacea*. The type locality is Pacific Grove, California.

Ectocarpus cylindricus f. **codiophilus** f. nov.

Plate 46, figure 14, and Plate 49, figures 42–45

Frondibus dense caespitosis, 3–5 mm. altis, per filamenta rhizoidea dense intricata, hospitem penetrantibus; filamentis erectis prope superficiem anastomosantibus et furcatis, superne eramosis, piliferis, gametangiis plerumque prope basim filamentorum erectorum sitis.

Growing on *Codium fragile* (Suringar) Hariot and *Codium Setchellii* Gardner. Carmel Bay, Monterey County, California, and La Jolla, San Diego County, California. Type, Gardner, no. 3540*a* (Herb. Univ. Calif., no. 206992), December.

This form differs from f. *typicus* in having penetrating rhizoidal filaments and in that the gametangia are gathered in a dense zone at or near the base of the erect filaments instead of being scattered.

Ectocarpus cylindricus f. **acmaeophilus** f. nov.

Plate 49, figure 46

Frondibus floccosis, 7–10 mm. altis; filamentis repentibus superficialibus, filamentis erectis eramosis, diametro in parte quaque similibus; zoosporangiis ignotis; gametangiis usque ad 270μ longis, plerumque in parte superiore filamentorum erectorum oppositis.

Growing on *Acmaea* sp. Carmel Bay, Monterey County, California. Type, Gardner, no. 2884 (Herb. Univ. Calif., no. 206990), May.

This form seems to be rare, at least but few specimens have been detected up to the present time. It differs from f. *typicus* in being practically unbranched, except the fructiferous branches. Where branches occur, they seem to arise as the result of an injury to the main filament. It differs further in that the erect filaments are more nearly cylindrical throughout, and the gametangia more often opposite and generally longer and proportionally narrower.

Ectocarpus siliculosus f. **subulatus** (Kuetz.) comb. nov.

Fronds 5–25 cm. high, light yellow, fleecy, much branched, not constricted at the joints; branches long, attenuated above, many ending in a long hair; cells of the main filaments 30–36μ broad, 1–1.25 times as long as broad, zoosporangia unknown; gametangia elongated subulate-ovoid, some stouter, some more slender, 200–600μ long, 12–48μ broad, the upper (and as a rule more slender) usually terminating in a hair, on a 2–10 or 12 celled pedicel.

In brackish pools, on sticks or grasses. Central California (San Francisco Bay).

Ectocarpus confervoides f. *subulatus* Collins, Holden, and Setchell, Phyc. Bor.-Amer. (Exsicc.), no. 1231. *Ectocarpus subulatus* Kuetzing, Spec. Alg., 1849, p. 454, Tab. Phyc., vol. 5, 1885, p. 19, pl. 61, fig. II. *Ectocarpus confervoides* Hauck, Meeresalg., 1884, p. 331 (excl. synonomy). *Ectocarpus amphibius* Harvey, Phyc. Brit., vol. 2, 1848, pl. 183, Ner. Bor.-Amer., part III, 1858, p. 125.

Our plant seems to agree very well with the figures and description of *Ectocarpus amphibius* Harvey and also, although not so perfectly, with *E. subulatus* Kuetz. They are both brackish water forms, as are our plants. Hauck refers to his var. *subulatus* also *Ectocarpus draparnaldiaeformis* Kuetz. and *E. macroceras* Kuetz. Judging from Kuetzing's illustrations, these two species may be forms of *E. siliculosus* but are not to be included under f. *subulatus*.

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PLATE 45

Ectocarpus fructuosus S. and G.

Fig. 1. Diagrammatic illustration of whole plant.

Fig. 2. Part of a plant showing positions and various shapes and sizes of the gametangia. × 175.

Figs. 3, 4. Terminal ramuli showing variations in shape of cells and somewhat reduced gametangia. × 60.

Ectocarpus Mesogloiae S. and G.

Fig. 5. A single gametangium and a piece of terminal ramulus illustrating chromatophores and cells. × 200.

Fig. 6. A group of plants showing rhizoids, character of branching, relative shapes and sizes of gametangia. × 40.

Ectocarpus granulosoides S. and G.

Fig. 7. A group of terminal ramuli showing character of branching, shapes of cells, positions and shapes of gametangia. × 125.

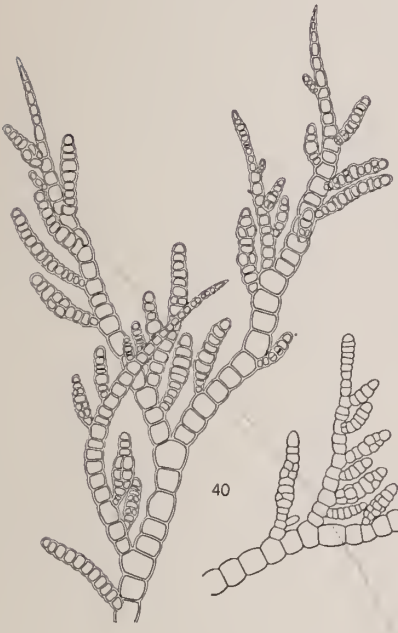
Fig. 8. A few cells of the main filament showing the shapes of cells and of chromatophores. × 125.

Ectocarpus simulans S. and G.

Fig. 9. Diagrammatic illustration of groups of plants on their host.

Fig. 10. Parts of plants showing shapes and positions of gametangia. × 125.

Fig. 11. A group of cells of the main filament showing chromatophores. × 250.



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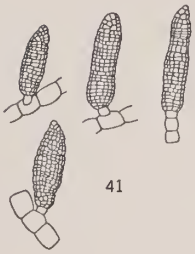
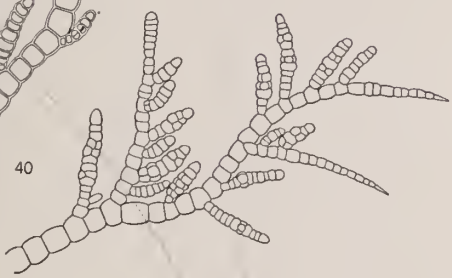
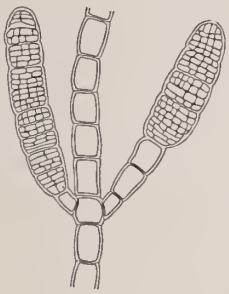


41

42





43

44

45

46

Vol. 6. 1914–1919.

1. Parasitic Florideae, by William Albert Setchell. Pp. 1-34, plates 1-6. April, 1914 ..... .35

2. *Phytomorula regularis*, a Symmetrical Protophyte Related to *Coelastrum*, by Charles Atwood Kofoid. Pp. 35-40, plate 7. April, 1914 ..... .05

3. Variation in *Oenothera ovata*, by Katherine Layne Brandegee. Pp. 41-50, plates 8-9. June, 1914 ..... .10

4. Plantae Mexicanae Purpusianae. VI, by Townshend Stith Brandegee. Pp. 51-77. July, 1914 ..... .25

5. The *Scinaia* Assemblage, by William Albert Setchell. Pp. 79-152, plates 10-16. October, 1914 ..... .75

6. Notes on Pacific Coast Algae. I, *Pylaiella Postelsiae*, n. sp., a New Type in the Genus *Pylaiella*, by Carl Skottsberg. Pp. 153-164, plates 17-19. May, 1915 ..... .15

7. New and Noteworthy Californian Plants. II, by Harvey Monroe Hall. Pp. 165-176, plate 20. October, 1915 ..... .15

8. Plantae Mexicanae Purpusianae. VII, by Townshend Stith Brandegee. Pp. 177-197. October, 1915 ..... .25

9. Floral Relations among the Galapagos Islands, by A. L. Kroeber. Pp. 199-220. March, 1916 ..... .20

10. The Comparative Histology of Certain Californian Boletaceae, by Harry S. Yates. Pp. 221-274, plates 21-25. February, 1916 ..... .50

11. A Revision of the Tuberales of California, by Helen Margaret Gilkey. Pp. 275-356, plates 26-30. March, 1916 ..... .80

12. Species Novae vel Minus Cognitae, by T. S. Brandegee. Pp. 357-361. May, 1916 ..... .05

13. Plantae Mexicanae Purpusianae. VIII, by Townshend Stith Brandegee. Pp. 263-375. March, 1917 ..... .15

14. New Pacific Coast Marine Algae. I, by Nathaniel Lyon Gardner. Pp. 377-416, plates 31-35. June, 1917 ..... .40

15. An Account of the Mode of Foliar Abscission in *Citrus*, by Robert W. Hodgson. Pp. 417-428, 3 text figures. February, 1918 ..... .10

16. New Pacific Coast Marine Algae. II, by Nathaniel Lyon Gardner. Pp. 429-454, plates 36-37. July, 1918 ..... .25

17. New Pacific Coast Marine Algae. III, by Nathaniel Lyon Gardner. Pp. 455-486, plates 38-41. December, 1918 ..... .35

18. New Pacific Coast Marine Algae. IV, by Nathaniel Lyon Gardner. Pp. 487-496, plate 42. January, 1919 ..... .15

19. Plantae Mexicanae Purpusianae. IX, by Townshend Stith Brandegee. Pp. 497-504. November, 1919 ..... .05

Index in preparation.

Vol. 7. 1916–.

1. Notes on the Californian Species of *Trillium* L. I, A Report of the General Results of Field and Garden Studies, 1911-1916, by Thomas Harper Goodspeed and Robert Percy Brandt. Pp. 1-24, plates 1-4. October, 1916 ..... .25

2. Notes on the Californian Species of *Trillium* L. II, The Nature and Occurrence of Undeveloped Flowers, by Thomas Harper Goodspeed and Robert Percy Brandt. Pp. 25-38, plates 5-6. October, 1916 ..... .15

3. Notes on the Californian Species of *Trillium* L. III, Seasonal Changes in *Trillium* Species with Special Reference to the Reproductive Tissues, by Robert Percy Brandt. Pp. 39-68, plates 7-10. December, 1916 ..... .30

4. Notes on the Californian Species of *Trillium* L. IV, Teratological Variations of *Trillium sessile* var. *giganteum* H. & A., by Thomas Harper Goodspeed. Pp. 69-100, plates 11-17. January, 1917 ..... .30

5. A Preliminary List of the Uredinales of California, by Walter C. Blasdale. Pp. 101-157. August, 1919 ..... .50

6, 7, 8. A Rubber Plant Survey of Western North America. I. *Chrysothamnus nauseosus* and Its Varieties, by Harvey Monroe Hall. II. Chrysil, a New Rubber from *Chrysothamnus nauseosus*, by Harvey Monroe Hall and Thomas Harper Goodspeed. III. The Occurrence of Rubber in Certain West American Shrubs, by Harvey Monroe Hall and Thomas Harper Goodspeed. Pp. 159-278, plates 18-20, 8 figures in text. November, 1919. 1.25

9. Phycological Contributions. I, by William Albert Setchell and Nathaniel Lyon Gardner. Pp. 279-324, plates 21-31. April, 1920 ..... .50

10. Plantae Mexicanae Purpusianae. X, by Townshend Stith Brandegee. Pp. 325-331. December, 1920 ..... .10

11. Phycological Contributions II to VI. New Species of: II. Myrionema; III. Compsonema; IV. Hecatonema; V. Pylaiella and Streblonema; VI. Ectocarpus. By William Albert Setchell and Nathaniel Lyon Gardner. Pp. 333-426, plates 32-49. May, 1922 ..... 1.50

Vol. 8. 1919–.

1. The Marine Algae of the Pacific Coast of North America. Part I. Myxophyceae, by William Albert Setchell and Nathaniel Lyon Gardner. Pp. 1-138, plates 1-8. November, 1919 ..... $1.50

2. The Marine Algae of the Pacific Coast of North America. Part II. Chlorophyceae, by William Albert Setchell and Nathaniel Lyon Gardner. Pp. 139-374, plates 9-33. July, 1920 ..... 2.75

Vol. 9. A Report upon the Boreal Flora of the Sierra Nevada of California, by Frank Jason Smiley. Pp. 1-423, plates 1-7. October, 1921 ..... 5.00

Vol. 10. 1922–.

1. The Genus *Fucus* on the Pacific Coast of North America, by Nathaniel Lyon Gardner. Pp. 1–180, plates 1–60. April, 1922 ..... 2.25